
SYMPOSIUM
ON
RAW HIDES & SKINS-CURING AND
PRESERVATION

CENTRAL LEATHER RESEARCH INSTITUTE

CFTRI-MYSORE



3881

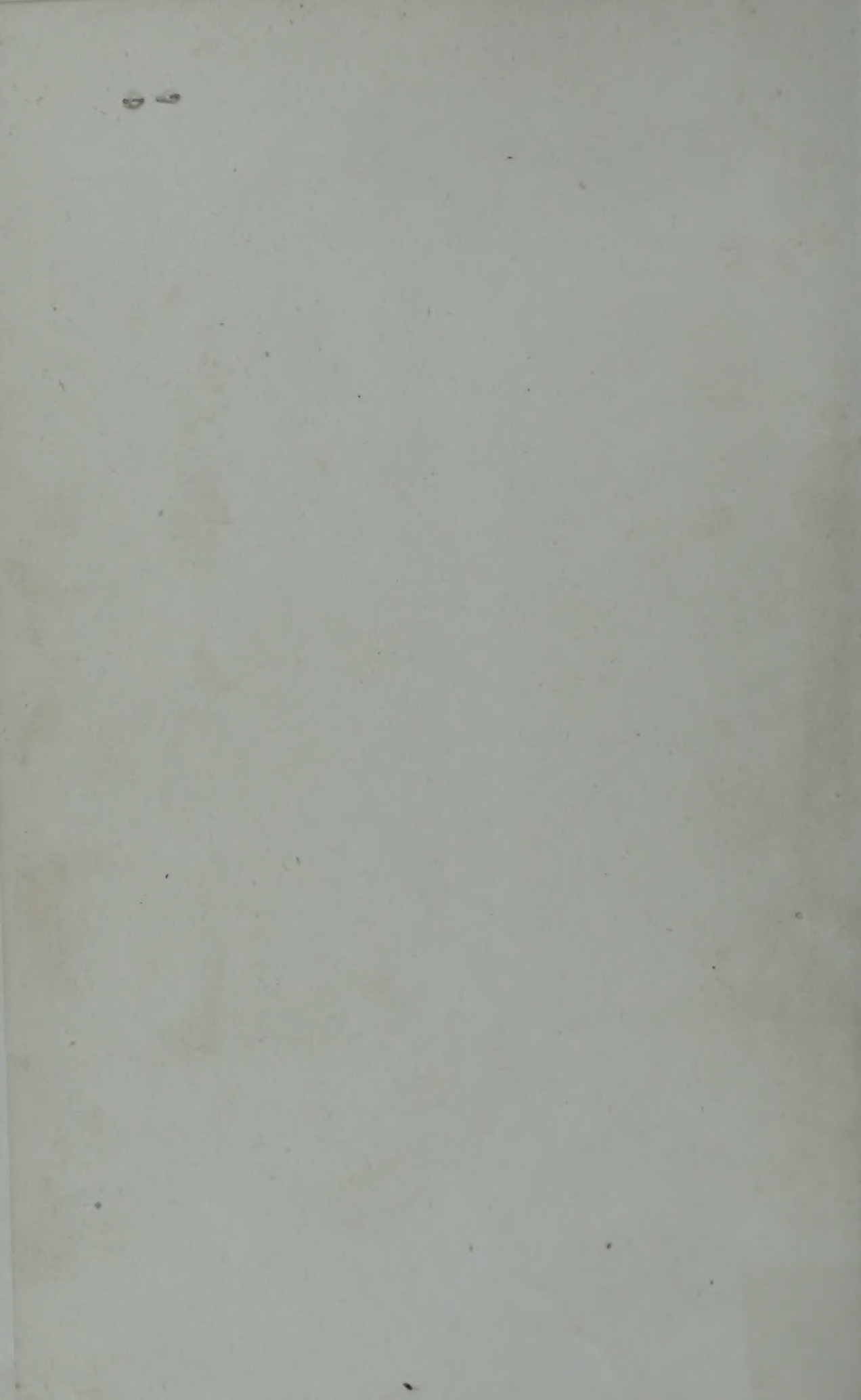
Symposium on raw



3881 ① indian tanning industry
② " leather — "

- ③ animal skins ⑭ animal skin damage
- ④ goat skins
- ⑤ animal skin curing
- ⑥ " " preservation
- ⑦ tanning ⑧ salt curing
- ⑨ flaying ⑩ carcasses
- ⑪ slaughterhouse by products
- ⑫ leather ⑬ ~~cattle~~ skin diseases

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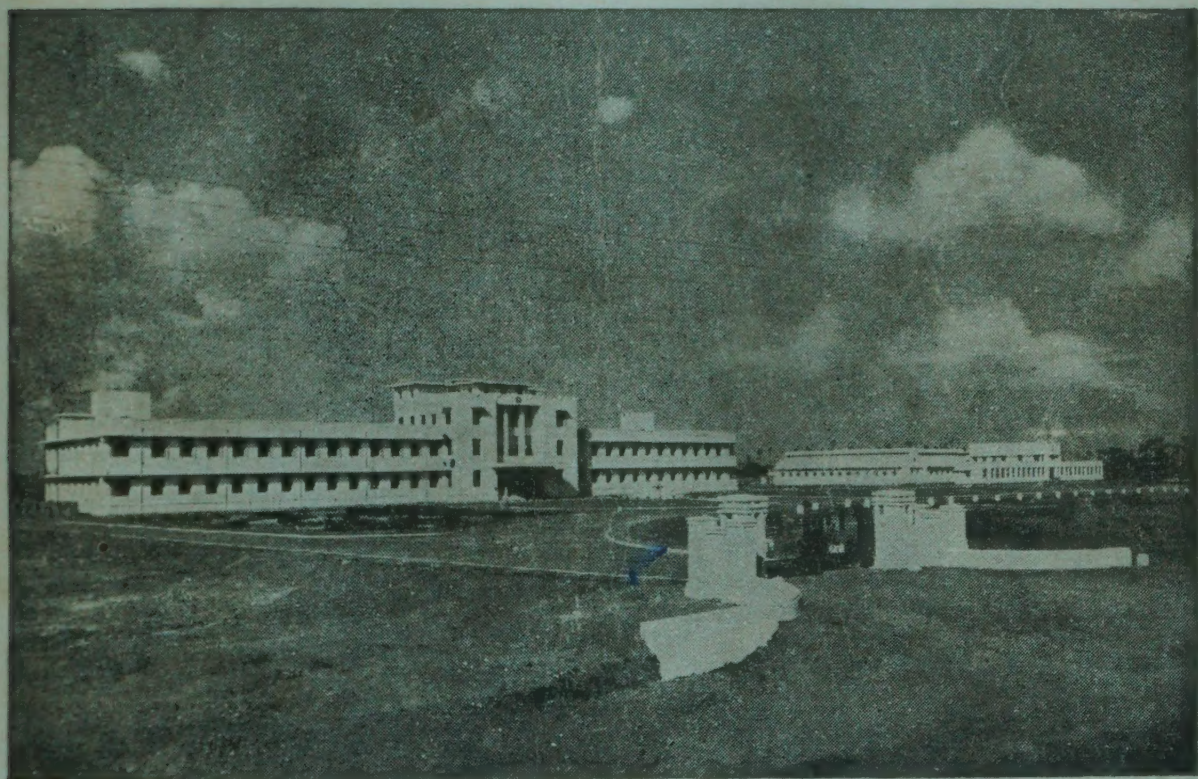
SYMPOSIUM

ON

RAW HIDES & SKINS - CURING AND PRESERVATION

(28th 29th and 30th March, 1957)

Proceedings and Technical Papers.



**Central Leather Research Institute,
ADYAR, MADRAS-20.**

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH-INDIA.

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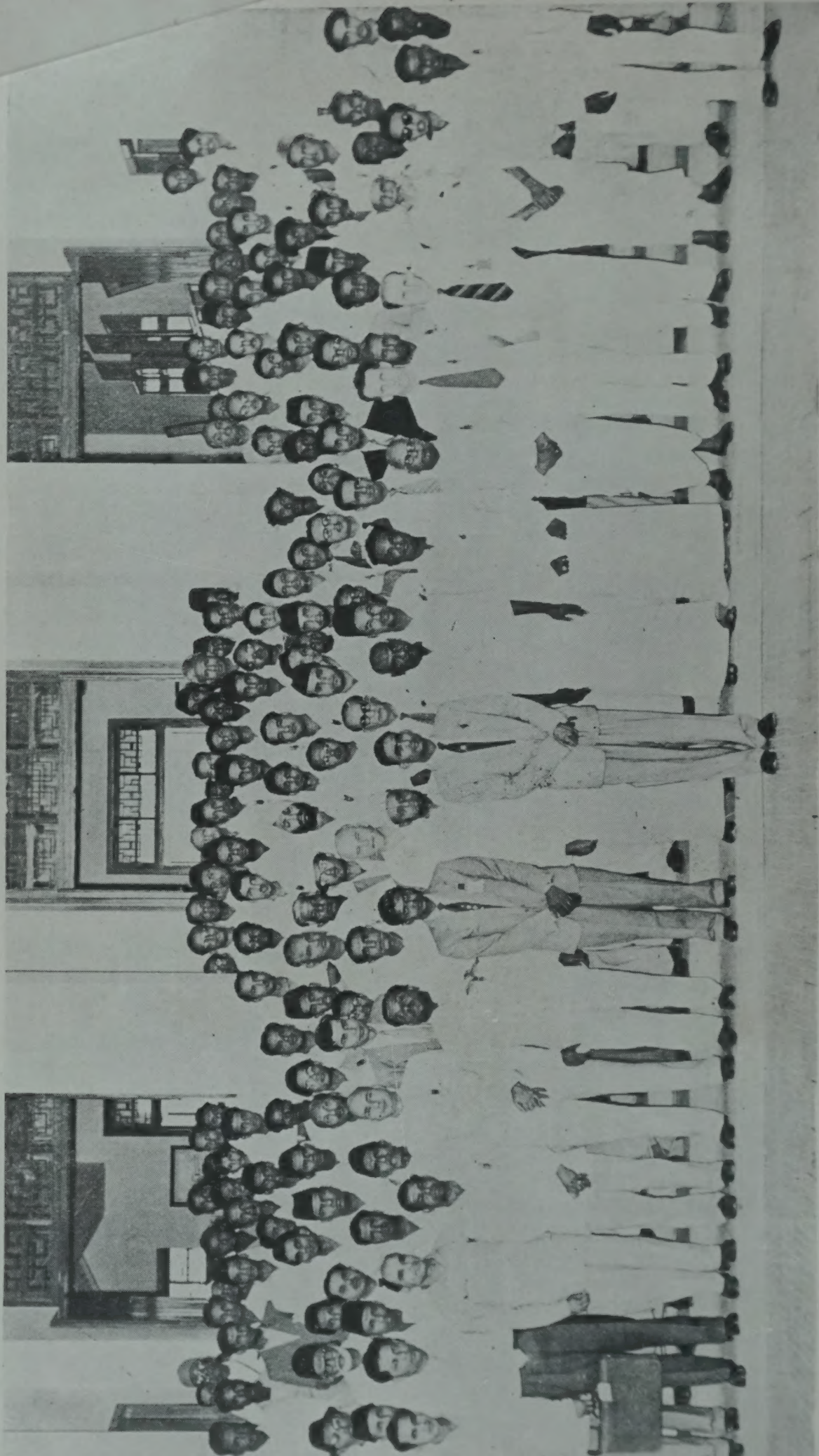


**Central Leather Research
Institute,**

ADYAR, MADRAS-20.

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH-INDIA.

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Group photograph of the delegates, members of the Tanning Industry with Shri K. Kamraj, Chief Minister, Madras State.

Proceedings of the Symposium on “Raw Hides and Skins—Curing and Preservation.”

Inauguration of the Symposium :

The inaugural function of the Symposium on “Raw Hides and Skins—Curing and Preservation” was held in the Auditorium of the Central Leather Research Institute, Madras on Thursday the 28th March 1957 at 3 p.m. Shri C. Subramaniam, Minister for Finance and Education, Government of Madras presided. Over 270 delegates from all over India and about 200 Hides & Skins merchants of the Madras State attended.

Dr. Y. Nayudamma, Assistant Director-in-charge, Central Leather Research Institute, welcomed the Finance Minister and the delegates who had come from the various parts of the country and said that the industry had been receiving much help from the Finance Minister and they were confident that Mr. Subramaniam would continue to be the Finance Minister in the new Cabinet also and extend to the industry the same kind treatment as hitherto. He explained the value of the symposium on an important subject like “Raw hides and skins—curing and preservation” and expressed the hope that the conference would be able to formulate schemes for the development of the industry. They were all sorry, he said, that Professor M. S. Thacker, Director-General, Scientific and Industrial Research, Government of India, who was to have inaugurated the Symposium could not be present on the occasion owing to urgent duties in Delhi.

Shri N. S. Mani then read out the messages received from :

- (1) His Excellency Shri A. J. John, Governor of Madras.
- (2) Shri M. J. Jamal Mohideen.
- (3) President of the Southern India Skin and Hide Merchants Association.
- (4) President of the Society of Leather Trades, Chemists and Australian Leather Chemists' Association.
- (5) Mr. Valenta, Bata Shoe Co. Ltd.

The Minister was then garlanded.

Shri N. M. Anwar, Honorary Secretary, Southern India Hides & Skins Merchants Association, declared that it was a privilege and pleasure for him to associate the industry with the Institute on the occasion of the Symposium. He thought it was the cause of Science, industry and foreign exchange, that was responsible for having the Finance Minister, in their midst. For theirs was an industry which was contributing annually, through the port of Madras to the national wealth to the tune of Rs. 250 millions and thus earned the badly needed Foreign Exchange resources. This amount was only a fraction of the full potentiality of this industry and full development of this would be possible only through the co-operation of the Central Leather Research Institute.

This Institute, which was one of the 17 national laboratories, established in our country, in the wake of national freedom, thanks to the statesmanship of the Prime Minister, Shri Jawaharlal Nehru, had already been able to modernise the outlook in the techniques of this leather industry. The speaker looked forward to a time when the researches carried out at the Institute would supplant the badly needed imported raw materials, with indigenous ones and thus help in saving considerable amounts of Foreign exchange ; the ultimate goal for the country would be to export not merely raw hides and skins but also finished products.

Shri Anwar then feelingly referred to the loss sustained in the sad demise of Professor B. M. Das who "was responsible for laying the foundation of this Institute and of the cause of research in our Industry." He however felt relieved that they had in the successor, Dr. Y. Nayudamma, a friend under whose guidance the Institute would prove to be utmost help to the Industry.

Addressing the Finance Minister, Shri Anwar said that the Industry required substantial aid from the Government of Madras, in addition to the concession shown with regard to Sales Tax. As one of the cottage industries, the leather industry also must be given sufficient backing and support. Without which it would land in a crisis. This industry had reasons not merely for survival but also for progress and growth as an earner of foreign exchange. Shri Anwar concluded by saying that he was confident that the Finance Minister, would be receptive to their appeal and to his best for them.

Shri G. S. Sreenivasa Iyer, Vice-President, the Southern India Hides & Skins Merchants' Association, said he joined the Honorary Secretary in welcoming the Finance Minister and in appealing for aid to the industry. He welcomed these Symposia for they afforded opportunities of meeting and exchanging ideas with the experts from all over India. He reiterated the need for improving the quality of the finished goods so that they could be exported. It was in this context that the present Symposium was important as it dealt with the foundation of the process of tanning. Stressing the need for better quality skins and hides, the speaker said that while natural defects due to bad nutrition could not be easily remedied, the other natural defects caused by pex, warble etc. could be avoided if suitable steps were taken by the officials concerned. As regards defects in curing, these were in some cases, due to scarcity of salt and water and in others to carelessness. So the departmental officers should see that the facilities for curing were available and that the skins & hides were properly cured. The Railways could co-operate by providing wagons without delay and by giving priority for transport of hides & skins. The supply of wooden wagons would eliminate stains caused in transit.

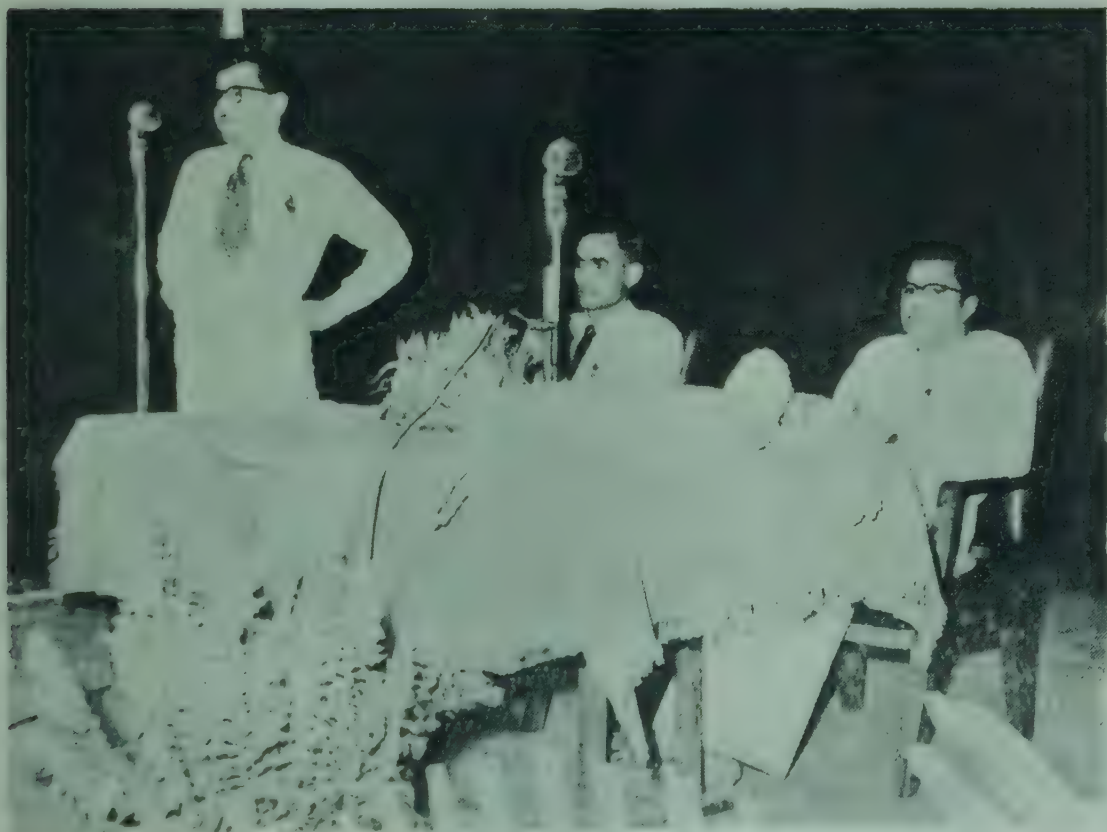
In conclusion, Shri G. S. Iyer stated he hoped for much enlightenment from the delegates on the various aspects of curing and preservation of raw hides & skins.

Professor M. S. Thacker's recorded inaugural address in Hindi, was then replayed and Dr. Nayudamma next read out the English translation of the same.

Professor Thacker said in his address that he had been looking forward eagerly for the opportunity of meeting the representatives of



Shri C. Subramaniam, Minister of Finance, Madras State,
delivering the Presidential address. Dr. Y. Nayudamma
Seated to his right.



Dr. S. K. Barat proposing a vote of thanks.

tanning industry so that he might tell them how deeply they in the Council of Scientific and Industrial Research appreciated their very keen interest in the activities of the Central Leather Research Institute and the continued guidance and goodwill offered by them to that Institute. Referring to the symposium, Professor Thacker said that a meeting of people of varied interests coming together for a good cause, namely the development of the Indian Leather Industry, was indeed a welcome feature and his pleasure was, therefore, all the greater in inaugurating the deliberations of that important symposium on "Raw Hides and skins—Curing & preservation. "India", he pointed out, "is singularly fortunate in the field of leather, being the largest single holder of livestock in the world. It is estimated that the leather industry fetched about 300 million rupees annually to the Indian Union."

Professor Thacker said :

"Leather has been used from time immemorial and the uses and the market for it are ever expanding. With the introduction of the ban on cow slaughter in the majority of the States in India, a serious problem has arisen for the tanner. The quality of the raw hides and skins is reported to be deteriorating gradually and the tanner and the tanning technologist are faced with the challenge to produce good quality leather from bad hide. An expanding market for leather and the increasing hide deterioration militate against each other and this basic fact calls for a searching of minds, pooling of thoughts, sharing of ideas and chalking out of a clear-cut co-ordinated programme. Realising the importance of this problem, the Governing Body of the Council of Scientific and Industrial Research approved of the holding of this Symposium so that the various sections of the tanning industry, namely, the livestock man, the flayer, the raw hide dealer, curer, distributor, the tanner, the finisher and the seller could be brought together to discuss the problems. The tanner is mainly interested in raw hides and skins. The prosperity of this industry, therefore, depends to a very large extent on how far you are willing to join together in a concentrated effort and do everything in your power to develop the quality of hides and skins and to meet the increasing demand for finished leather."

Explaining the purpose of the Symposium, Professor Thacker said : "I sincerely trust that this symposium organised by the Central Leather Research Institute and this coming together of all the segments of this industry having a vital interest in raw hides and skins will have the way to find proper solutions for your problems. The Council of Scientific & Industrial Research has established 17 National Laboratories all over India. Each one of them is dedicated to service of the industry to which it is allied. It is the desire of the Council and that of the Central Leather Research Institute should serve as a bridge between science and industry. Most of you believe in investigating your own methods of doing business, your accounting, financial structure, your sales and sales promotion—all of which you do with the singular idea of improving the figures of your balance sheet. I am sure that most of you realise that such investigation on the business side are only one aspect of the matter. There is still another aspect. This investigation is closely related to the figures in your balancesheet and this goes by the name of research. It is to conduct this research and to disseminate the results of such research to the practical tanner, that the Central Leather

Research Institute has been established. The holding of symposia at this Institute was but one of its many activities to bring home to all, the results of such research.

For the progress of any industry or any nation, proper planning based on new ideas was essential. New ideas emanated from people sitting in conferences, exchanging their thoughts, sharing their knowledge by frank discussion and co-ordinated co-operative efforts. Symposia of the present type, were, therefore very necessary for finding the solutions for the problems facing the industry. He had every confidence that the decisions arrived at as a result of the discussions would go a long way in the development of the raw hides and skins and the leather industry.

Prof. Thacker ended his address with the suggestion that as the quality of raw hides and skins was the most important factor in the development of leather, every one of those engaged in the field, might join together and form a National Hide bureau or National Hide Association with a view to advise the public and private industry and the Government as to what effective steps should be taken from time to time to improve the quality of hides & Skins.

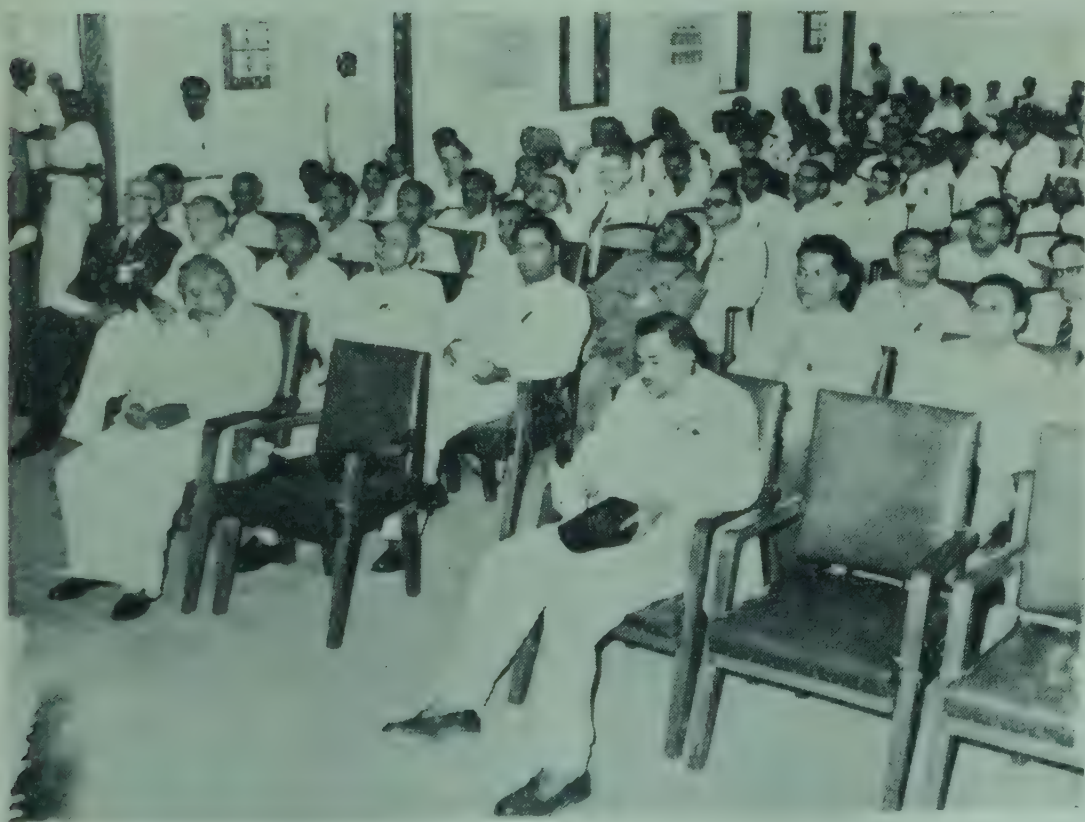
The President, Mr. Subramaniam said he was sure that exchange of ideas between the delegates from all over India would benefit the leather industry and he had no doubt that they would be able to make very good progress in utilising those resources to the best advantage of the nation. If the industry was to properly develop they should get first-rate hides and skins. In that context, the attention that the Government were paying to the development of animal husbandry was helpful to the industry though it might be in an indirect way. He said he had occasion to visit some tanneries in the course of his election campaign and he found that very primitive methods were still being used for slaughter and flaying of animals.

The Minister said that from what he could see from the recent cattle show he was of the view that they were making good progress in the development of the cattle wealth. That would help them to get better hides and skins. The necessity for proper curing and preservation was emphasized by the previous speakers and they pleaded for facilities for the tanneries in the State. He said that he agreed that tannery was an important cottage industry and it should be helped. The difficulty was they were all dispersed over the State in small units. The need for proper method of flaying was emphasised. To meet the demand, the Government has started training course in flaying in the Veterinary College. The complaint was that those trained in the course were not able to find employment. That was serious problem and so he would plead with the representatives of the trade to help them as otherwise, the training course would not attract men. He suggested that the best way to get well flayed and salted hides and skins from the rural parts would be for the butchers there to form co-operatives. The representatives of the trade also could help them by giving them financial and other forms of aid.

Mr. Subramaniam assured that the Government would be always willing to help the industry if proper schemes were formulated by the representatives of the industry and presented to them. The Govern-



Shri C. Subramaniam, going round the exhibition.



A section of the gathering on the occasion of the inauguration of the symposium.

ment were quite aware that the industry was earning exchange including dollars. For the development of the country, they had been depending upon foreign help to some extent and in return for that help they in this country should be able to give something. In that respect, the leather industry offered good scope. They should make proper and maximum use of the skins and hides available to them and in that respect, the research work done in the Central Leather Research Institute would be valuable.

Dr. Y. Nayudamma then presented to the Minister a rose flower made of leather waste.

Dr. S. K. Barat proposed a vote of thanks.

FIRST SESSION

Technical Session No. 1.

28th March 1957.

(4-30 p.m. to 6-30 p.m.)

The First Technical Session of the Symposium was held in the Auditorium of the Central Leather Research Institute under the Chairmanship of Sri R. K. Rangan, Joint Barat Chief Controller of Imports and Exports and Ex-Officio Chairman of the Leather Export Promotion Council of the Government of India. Dr. S. K. Barat introduced Sri Rangan to the delegates and proposed him as the Chairman.

The Chairman, while thanking the organisers of the Symposium for having elected him to preside over the deliberations of the First Technical Session, said that the main objects of the Leather Export Promotion Council were (i) to promote exports of tanned leather and raw hides and skins (ii) to ascertain the requirements of buyers with reference to quality and quantity and (iii) to assist the exporters in satisfying the requirements of the buyers. He hoped that with the technical assistance available they would be able ere long to satisfy the demands of the buyers and meet their requirements fully. For the co-operation of one and all connected with the Industry was necessary. He was sure that the Government of India and all the State Governments would do all in their power to canalise the trade and regulate to the best advantage of the country.

The following papers were then read :

1. Future Development of Indian tanning Industry—by J. J. Walters, Guildford, Surrey, England—read by V. S. Padmanabhan.
2. Collection of raw goat skins on a co-operative basis—by R. V. Sovani—read by G. Roy Choudhury.
3. Note on collection of raw hides and skins and suggestions for improved methods by L. M. Hira, Superintendent of Markets, Greater Bombay.
4. Supply of quality raw hides and skins to Tanners' Co-operative Societies etc. by C. V. Gangal, Tanning and Leather Expert, Industrial Co-operative and Village Industries.
5. Improvement of Raw hides and skins by N. S. Mani, Central Leather Research Institute, Madras. (This paper was deemed to have been read, as the article had already appeared in the newspapers.)
6. "Exports of Raw Hides and Skins" presented by the Calcutta Hide and Skin Shippers' Association—read by N. S. Mani.



Delegates, members of the Tanning Industry and the staff of C.L.R.I. with Sri R. K. Rangan, Chairman of the Leather Export Promotion Council.

Discussion.

With reference to Dr. Hira's paper, Dr. Barat drew attention to the unnecessary pain and agony caused to the animals while slaughtering and enquired whether this pain could not be minimised by using Casting Rotary Pens.

Dr. Hira replied that his experience showed that nowhere were humane methods of slaughtering applied. The usual method of cutting the throat meant acute pain and agony to the animal. The Casting Rotary Pen was used in big slaughter houses in London. It was a simple barrel-like machine, in which the animal would be laid down and tied and shot in the head. Of course the method was costly requiring nearly Rs. 26,000. Here in India the leather trade was in the hands of the Muslim community and religious sentiments played an important part. He was not sure whether the casting pen method would be acceptable to the butchers' community and was of the view that the Muslim community might continue with their usual methods.

Dr. Y. Nayudamma wanted to know the author's views regarding the use of automatic flaying machines. Another point he raised was the desire of the butchers to avoid over-sharpness of the knife.

Dr. Hira replied that the butchers in Bombay were efficient flayers and hence there was no need for flaying machines at all. In some foreign countries he had not come across these flaying machines.

As regards the second point, they in Bombay had evolved an improved type of knife with a curved handle. The complaint from the butchers was that the wooden handle of the knife was rather too heavy. He was sure that in course of time better and improved methods would be found out.

Shri A. P. Palit (Orissa) said that he had witnessed the operation of flaying machines in Heidelberg in Germany. The main advantage in using flaying machines was the elimination of cuts. It took only seven minutes to flay a big cow weighing about 110 kilos.

Dr. Hira replied that the flaying machines were worked with electricity and in India there were many places where electric power was not available. The Indian flayers had come up to the expectations of foreigners and there was no need at all for flaying machines. The methods followed in slaughter houses in Bangalore were, no doubt, outmoded, but the percentage of cuts and bruises was negligible.

Dr. Nayudamma wanted to know whether they should accept the principle of using flaying machines or not. Though personally he would not like importing machines they had to consider whether if finances permitted flaying machines could be introduced in regions like the South.

Dr. Hira explained that he was not against adopting modern methods; flaying machines were worth trying as they reduced the number of cuts.

Mr. F. H. Hock said that the purpose of bleeding the animal was to increase the keeping quality of the blood and also to remove the blood from the hide. In the Casting Pen method, the animal was

ties before being shot and so the bleeding was affected; this in turn affected the quality of the hide. In his opinion, the legs should be loosed. He wanted to know the views of the author in this matter.

Dr. Hira said that the Casting Pen method minimised the struggling of the animal. In the other method, the animal was put in a small box with a protrusion and its throat was cut. The carcass was taken out and the bleeding completed. For meat to be good, the animal should bleed well.

Mr. F. H. Hoek said that it was not humane to hoist the animal until it was absolutely lifeless. He agreed with Englishmen that bleeding might be affected if that was done. They in India could have an experimental plan for pneumatic flaying.

Shri N. M. Anwar, while endorsing the views of the speaker said that an animal was butchered more for its meat. The hide was only a bye-product. The Halal method was meant for the preservation of the meat. In his view, the "Halal Method" had come to stay.

Dr. Hira replied that even in the application of the Casting Pen method, the cutting was done by the Halal method. The important point was that the animal should bleed well if the quality of the meat was to be good. In foreign countries like Denmark their primary object was to get good quality meat. Hides played only a secondary role.

With reference to the paper read by Shri N. S. Mani, Shri B. N. Soni, Research Officer, Indian Veterinary Research Institute, Izatnagar (U.P.) said that he wanted to clarify the position. Warble flies were present in most parts of Northern India, particularly in East Punjab, Rajasthan, U.P., Bihar, certain parts of West Bengal and were widespread in the Himalayan Range stretching from Kashmir right upto Darjeeling. They were bound where the atmosphere conditions were dry and arid. Milch cattle were now being taken from North India to South India. His latest information was that the warble flies had spread downwards upto Poona. The only remedy he would suggest was to restrict the movement of the cattle during a certain period of the year. If this was not done there would come a time when no part of the country would be free from the warble. This restriction of movement could be done by legislation or through proper treatment of the affected animal or by applying the various measures which they had found effective after considerable research.

Winding up the discussion, the Chairman said that after listening to the deliberations held so far, he was of the opinion that because of lack of proper curing and preservation of the hides they got only a negligible return from the vast resources available in India. The valuable suggestions made by the various delegates would be taken note of both by the Central Leather Research Institute and the Leather Export Promotion Council and would be closely examined by them in their respective spheres and all possible steps should be taken to find a solution to the problems confronting the industry. He would request the various delegates to communicate to them the results of the experiments conducted in their units for the benefit of all. He had no doubt whatsoever that with the co-operation of one and all concerned, they would improve



Dr. Y. Nayudamma taking Shri K. Kamraj, Chief Minister, Govt. of Madras round the exhibition held during the symposium.



Dr. Y. Nayudamma taking round the exhibition Shri C. Subramaniam, Minister of Finance, Govt. of Madras.

and steal a march over other countries. He thanked the organisers of the symposium particularly Dr. Nayudamma, for having given him the opportunity to take part in the deliberations.

Shri M.A. Ghani proposed a vote of thanks.

Second Session.

The Second Technical Session of the Symposium was held in the Auditorium of the Central Leather Research Institute at 10-15 A.M. under the chairmanship of Dr. S. N. Sen, Central Leather Research Institute.

The following papers were read:

1. Preservation of Indian goat skins for export by M. Dempsey and B. M. Haines, The British Leather Manufacturers' Research Association, Milton Park, Egham, Surrey—read by V. S. Padmanabhan.
2. Raw hides and skins—curing and preservation by D. Woodroffe, Northampton College of Technology, Northampton—read by G. Roy Choudhury.
3. Factors affecting the salting of raw hides and skins and their preservation by S. C. Nandy & S. N. Sen, Central Leather Research Institute—read by S. C. Nandy.
4. Some aspects of curing practices by the Ministry of Commerce and consumer Industries, Small Industries Service Institute—read by S. Nagarajan.
5. Some considerations on the utilization of bittern salt in curing by S. C. Nandy and S. N. Sen, Central Leather Research Institute—read by S. C. Nandy.

(At this stage, the delegates adjourned for tea. After tea, the following papers were read)

5. Curing of hides & skins—presented by R. K. Bhagwat, the State Industrial Coop. Assoc. Ltd., Bombay—read by C. V. Gangal.
7. Pickling hides and skins as a method of preservation—presented by R. K. Bhagwat State Industrial Co-op. Asscon, Ltd., Bombay—read by G. Roy Choudhury.
8. Improved Standards of Curing—read by Sen Gupta.
9. Brining of animal hide—its merits and demerits—by S. C. Nandy, Central Leather Research Institute.
10. Some considerations on the utilisation of bittern salt in curing—by S. C. Nandy & S. N. Sen, Central Leather Research Institute
11. Preservation of hides and skins by S. N. Sen, Central Leather Research Institute.

Items 9 to 11 were taken as read.

Discussion

Referring to the comparison of Indian and European methods of preservation of hides, by Shri Nandy in his paper. Shri Sen Gupta pointed out that in comparing the methods, the climatic conditions prevailing in the regions should be taken into account; the Indian climate was very useful in respect of preservation of hides.

Shri Nandy replied that he had not actually compared the two methods. He had said that in European climatic conditions, the cured skin could be preserved for one year while under Indian conditions, it could be preserved only for six weeks.

Shri Gangal referring to the addition of chemicals in preservation, namely, 4% soda and 1% naphthalene, enquired whether it was on the basis of raw hides or salt. He said that introducing salt with the chemicals would be very difficult. Apart from the increasing cost, the new method would not prove to be a success in practice unless the salt to be used for curing was made available to the tanning industry at a cheap rate.

Shri Nandy replied that the percentage of soda to be added to the raw hide would vary according to different conditions. He admitted that chemicals to be added to common salt should be cheap. But there could be nothing cheaper than sodium carbonate; the butchers in villages were not supplied with even common salt, and so they could not use chemicals. Still cheap chemicals could be suggested. Some of the other chemicals tried were much more costly and were not available in India.

Shri Ghosh said that in India some exporters treated the hides and skins with special antiseptics like pentachlorophenate and with other surface active agents and then supplied them to the importers abroad. But the total weight compared with khari salt came down. The importers abroad, however, treated them only at the usual weight rate. Therefore, the Indian exporters stood to lose by treating the hides and skins in the special method. Unless the importers abroad were convinced about that, there will be always some practical difficulties.

Shri R. Selvarangan referred to the various methods of preservation and observed that cold storage and freezing methods could not be followed in India; pickling could be adopted in the case of deer and wolf skins. But if the skin was kept in pickled condition, the strength would fall down. With dried hides and skins, subsequent processing would be difficult. The only method left was salting. Even there, in respect of wet salting, the same type of weather did not always prevail. Some kind of salting process was being followed in a traditional way; this was not in any way the result of research. It had been reported though salt removed water the process had many defects. The addition of disinfectants and antiseptics were reported to improve the salting process. He, therefore, enquired (i) whether curing could be done without adding salt, i.e., whether salt was essential for curing, (ii) whether some tablet could be supplied which could be dissolved in water and (iii) whether it was possible to dry the skins in solvent medium.

He further pointed out that aluminium and formaldehyde had tanning action. Therefore, he wondered whether aluminium and formaldehyde could be used as adjuncts with disinfectants and antiseptics and whether they could thus do away with salting.

Shri Barat referring to the paper read by Shri Nandy said that it had been pointed out that there were some difficulties experienced by the overseas tanners regarding the soaking back of the sea-salted hides and skins. So far as he was aware, it was only in respect of goat skins. There was no such trouble with regard to sheep skin as it contained much more of fatty substance than goat skin. He suggested that experiments might be conducted regarding the use of salt on various hides and skins before making any recommendation.

Another question was whether they could fix a standard for raw hides and skins, and if so, what would be the criteria for fixing it.

It seemed that the soluble hide substance might be taken as the basis.

With regard to stains, it was reported that sodium chloride or pentachlorophenate was very effective in preventing deterioration of hides and skins. They did not affect the hides and skins in any way. Of course, there was a complaint that there was darkening of the stain if sodium pentachlorophenate was used. The questioner invited the suggestions of the delegates on all the points raised by him.

Shri Nandy, replying to the points raised, said that bittern salt had been tried on goat skin but not on sheep skin or cow hides. The foreign investigators had said that the objection regarding soaking back was mainly due to the chemicals like sodium carbonate. From experiments conducted in India, it was found that if soaking was done at higher temperatures, the difficulty in resoaking was minimised.

Regarding evaluation of raw hides and skins, investigations were still going on. Curing factors also had to be considered, because the quality of raw hides and skins affected the quality of the cured stock also.

Regarding the point raised by Shri Selvarangan, people were not getting even common salt easily. The hereditary muchis did not care whether the hides and skins were cured or not. They just took them to the intermediate dealers who actually cured them. Naturally the hides and skins were allowed to putrefy for a long period. He could not visualise any other method of curing, that is, curing without the use of salt. He felt that salt was not considered a pesticide.

Mr. Hoek stated that air dry curing was not touched upon at all in any of the papers read. Some researches had been carried out in France in this regard and the method followed in France could be tried in the Research Institute. Hides were being spoiled in the villages by being kept in open places spread on the ground. These hides could be treated with air dry curing and preserved. In this method they could use even bamboos. The questioner wanted to know whether the Central Leather Research Institute had conducted any research in this regard.

Dr. Nayudamma made the following observations :

- (i) Dr. Sen had done a lot of work regarding a substitute for Khari Salt. There was a substitute for salt and the Extension Service staff would soon demonstrate its use.
- (ii) He invited the representative of the Railways to answer the point raised with regard to wagon facilities.
- (iii) It was a wonder why brining had not come into vogue in India. He would not understand what practical difficulties stood in the way of its introduction.
- (iv) The Madras Government had already provided some storage rooms for the use of the tanners in one or two places.
- (v) The question of doing away with salt was always in the minds of the research workers. So far no suitable substitute had been found. They were now trying to find out on a long-range basis what structural changes took place as a result of the use of salt. However, salt had its own advantages. By putting it in water, all the solubles were removed.

Further it was cheap and was abundantly available. Therefore, it was also a moot point whether it was worthwhile doing research to stop the the use of salt.

Trials had been made with regard to the use of aluminium and formaldehyde also. Aluminium had its own tanning effects. He would only welcome any company which would come out with such tablets to be used in curing. What he said about the use of salt applied to the use of disinfectants without salt.

It was true that the trouble in soaking was only in respect of goat skins. Formerly, the bittern salt as it came from the Sambar Lake was used and it contained an abnormal amount of sodium carbonate and bicarbonate, which naturally did affect the hides and skins. There was a paper dealing with the effect of alkalinity on shrinkage of fibres. The question of fatty acid content in skins should be followed up by the research group in the Research Institute. They had already tried in the Institute the use of didwana salt in dry salting, wet salting and storage both on buffalo hides and on cow hides. Mr. Sarkar had conducted the research and the results would be published. It had been proved that didwana salt was inferior to any other salt used for curing. The present salt did not contain as much alkalinity as was thought of. So, it would not be correct to attribute the difficulty caused to the presence of alkalinity. He thought there might be some catalytic effects which had to be looked after because they might cause some damage to raw hides and skins. This was an offshoot of Dr. Barat's remark about fatty acid.

To fix criteria for assessment of hides and skins was a difficult question. The insurance agent would say that the stock was cured all right and that the damage was caused only in transit. No quick

method of assessment had yet been arrived at. It deserved the attention of all to find out a fairly rapid, reliable and accurate technique.

The effect of the preservatives on the skin also was a point to be considered.

The speaker next asked the Small-scale Industries representatives what effective steps were being taken to implement whatever was found to be good. A lot of research was being done in the Research Institute. Those organisations were for the dissemination of knowledge that the decisions were not being implemented and was it because they did not have the requisite paraphernalia or the necessary men to implement them.

Shri S.N. Bose inquired whether the percentage of soda ash to be used in admixture with salt for curing depended on the weight of salt or on the weight of hides.

Shri C. V. Gangal said in the villages of Bombay State not even a bucketfull of water was available. He washed hides with his hands and applied some salt to the hide. Thus if some ten animals died in a month, one hereditary artisan would get about Rs. 80 and he was satisfied. He did not apply any chemicals. Therefore, he thought legislation might be introduced to enforce brining the dead animals as soon as they died, to the flaying centres to be established. The All-India Village and Khadi Industries Board was giving loans and subsidies to such centres. But the dead animals were not brought to those centres at all. There were so many people in the villages who were eating the flesh of the animals itself. They could not eat it if the dead animals were to be brought to those centres at all. Therefore, there should be a more rational and practical approach to the problem than a technical or scientific approach. There should be two centres established, one at the taluka level and another at the district level.

Shri Srinivasan of the Southern Railways said that he attended the Symposium in order to take note of any interesting points which might be helpful to him in dealing with day to day problems regarding wet skin or tanned leather. The railwaymen were not business people but were servicemen. Normally the trader was bitterly critical of the Government or the Railways, more so when the consignment got delayed. He would then say that the consignment had lost its value and that it was badly damaged. He would want compensation to be paid to him in thousands of rupees. He would say that the damage caused was 80%. As laymen, the railway people would say by way of compromise that it was only 10%. But now the discussions at the Symposium had given him an indication of the durability and condition of the skins.

Regarding supply of wagons, he could not give any concrete suggestion in his personal capacity.

The delegate from Lucknow said that he was doing some work for improved flaying and curing of hides, especially of fallen hides, that

were available in the rural areas. More than 80 per cent of the hides in Uttar Pradesh and in the rest of the country was obtained from the rural areas, the rest (mainly buffalo hides) being from the slaughter houses. Only fallen hides were obtained from the rural areas where they were handled by unskilled technicians who could not afford even to purchase some salt for the preservation of the hides. Due to the ban on cow slaughter, good quality hides for finished upper leather were not available.

Continuing, the delegate said that there were four mobile hide-flaying units going from village to village and giving practical demonstrations in the improved methods of flaying hides. The staff requested the people in the villages to inform them whenever any animal died. On receiving the information, they went there and gave a practical demonstration of the improved method of curing the hide, by suspending the same on a four-sided wooden frame which was the cheapest and easiest method. If any improvement had to be made in the quality of the fallen hides, the village flayer would have to be convinced that he would earn thereby something more. The delegate, for his part, had requested his department and the Government also to distribute good quality flaying knives free of cost and also four-sided wooden frames to the flayers so that they might be able to do their job well. That type of inducement produced satisfactory results. In an area where about 10 wooden frames were distributed, more and more village flayers came forward asking for them. They distributed some more framed but told them that when they got something more, they should also invest two or three rupees in the manufacture of those wooden frames. They repented and about 75 frames were manufactured by the flayers themselves.

After working in that way for five years, it was found that in two or three months after the hide-flaying party left the particular area, the village flayers reverted to their old methods. So, he had requested the Government and his department to persuade the already trained village flayers to organise themselves on a co-operative basis and to form co-operative societies. Ten such village flayer co-operative societies had been formed and each society was being given Rs. 6,000 as grant-in-aid for the construction of a simple flaying-shed. In that way, it was hoped to improve the quality of the fallen hides and utilise the carcasses fully.

In Uttar Pradesh they had established two Gosadans where useless cattle were kept. When cattle died, flaying and curing were done immediately. They had produced a lot of hides and sold from the Gosadans. They were found to be of very good quality. If Gosadans were established in other States of the country also where useless cattle could be kept, they could get plenty of good quality hides at least for their internal use.

Shri Nagarajan of Bombay, referring to the question of brining, said that the practical difficulty was in getting of 90% purity.

Continuing, he said that the Small Industries Service Institute was acting as the authority for co-ordinating the work done in other

national laboratories in this country as well as in other countries. They in the Institute were acting as technical advisers and studied the problems of the region and at all stages consulted the laboratories dealing with those problems and took their advice. Occasionally they visited the factories and whenever a problem arose, they left it to the Research Laboratory to conduct a research. They just spread the knowledge necessary technique not only on paper but by actual demonstration. They stayed with those people, showed them what to do and if any incidental difficulties arose, they gave them all necessary help. The Regional Institutes could rest assured that whatever techniques were devised by them were disseminated to the trade through technical papers in the form of bulletins in the regional languages. If any factory required any special technique to be developed, they referred it to the laboratory.

Shri Nandy, replying to the question of Mr. Hoek, said, that due to some practical difficulties, they could not carry out the drying experiment in their laboratory, but that they could do it in future. In this respect, field work was much more necessary because in the laboratory drying conditions were not available.

With regard to the kind of salt to be used, he had stated in his paper about the chemical constitutions of common salt with respect to curing. The Indian Standard Institute had also published some specifications with regard to that aspect.

As regards the question whether khari salt could be used, he felt that it would not be advantageous in wet salting though it might be useful in dry salting. During summer months, it would be better to preserve the skin with sodium sulphate and common salt because there would be much more humidity.

Brining was a process which should be carried out in India although the cost might be a bit high.

Dr. Sen in his concluding remarks made the following points. Asphalt tablets would not be of much help to tanners but the Indian Standard Institute might try them.

Sodium carbonate had to be mixed with the salt itself. Certain problems concerning the leather trade had been discussed and some experimental data were suggested to show that they were useful. For example, storing of salted hide in a certain temperature, humidity and moisture was shown to increase the efficiency of curing. It might not be possible for the ordinary people in the trade to afford such storage but probably it could be done on a co-operative basis or by the Government themselves. The use of antiseptics admixed salt was said to increase efficiency. All these problems required immediate attention.

It was necessary to have a Central Board of Curing and Storage so that advice might be sought from them if needed. That would stop the colossal waste which was sustained due to bad storage and bad curing. The Chairman expressed his desire that they should all sit together, study their problems and find out ways of tackling them and also of implementing their decisions.

Shri K. T. Sircar proposed a vote of thanks.

THIRD TECHNICAL SESSION

29th March 1957.

(2-15 to 5-30 p.m.)

The third Technical Session of the Symposium on "Raw Hides and Skins and Curing and Preservation" was held in the Auditorium of the Central Leather Research Institute at 2-15 p.m. under the Chairmanship of Shri B. N. Soni, Research Officer, Indian Veterinary Research Institute, Izatnagar (U.P.).

The Chairman, in his introductory remarks, thanked Dr. Nayudamma and his colleagues for having conferred on him the honour of presiding over the deliberations. The subjects that were to be discussed during the Session would be quite different from those discussed earlier. When dealing with the insects, they had no deal with the living animal and also the biological factors. He had carried on considerable research in the Indian Veterinary Research Institute and he would be explaining the salient features later on when he read his paper.

The following papers were then presented.

1. "Some aspects of the Biochemistry of Raw Hides and Skins" by S. M. Bose, Central Leather Research Institute.
2. "Studies on the prevention of insect damage to hides and skins" by R. Bhaskaran and S. N. Sen, Central Leather Research Institute—read by Bhaskaran.
3. "Histological study of the effect of post mortem changes on the leather forming qualities of calf-skin" S. K. Sarkar and S. K. Mitra, Central Leather Research Institute—read by S. K. Sarkar.
4. "A note on the damage caused to the skin of cattle, sheep, buffaloes and goats by parasites" by V. S. Alwar, Madras Veterinary College.
5. "Parasitic skin diseases of animals and their effects" by R. Bhaskaran, Central Leather Research Institute.
6. "Viral, Bacterial and other diseases causing damage to live hides and skins" by K. P. Chandrasekharan and B. Narasinga Rao—read by K. P. Chandrasekharan.
7. "Certain parasitic infections of cattle involving the skin" by M. Anantaraman, Research Officer (Helminthology) Veterinary College, Madras.
8. "Some defects in raw hides and skin and suggestions for their improvements" by S. N. Soni, Indian Veterinary Research Institute.

Discussion :

Shri S. K. Mitra, Central Leather Research Institute remarked that except for rinderpest, the subject of fibral diseases had not been touched upon at all ; these diseases affected the inner layer of the hide. He wanted to know whether the fibres regained their normal strength when the animal had recovered from fibral disease or malnutrition.

Mr. F. H. Hoek enquired whether animals got a certain immunity against warbles. He knew that certain buffaloes developed a kind of immunity and that it was possible to increase the immunity in cattle.

Mr Vincent of Burma Shell Co. said that exporters of hides and skins suffered a loss due to the price going down as a result of damage caused by beetle to the hides and skins. He wanted this aspect to be examined in order to find out some measures to control this pest during transit.

Shri Jagadeesan (Standard Vacuum Oil Co.) wanted to know whether Shri B. N. Soni had investigated the possibility of the larvae developing immunity against chemical insecticides like Gammoxane and D.D.T. In anti-malarial operations they found that the larve developed such an immunity.

Referring to Dr. Soni's opinion regarding the method of dipping, Shri Alwar stated that the tick problem was a serious one in South India as almost every animal was affected by it. Therefore, he wanted to know whether dipping was considered to be impossible or not practicable.

Mr. Hoek wanted to know the view of Dr. Soni on the use of powder sprayers which had been found in America to be more effective than hand-dressing.

Shri Vijayarangam was of the view that Gammoxane spraying was very effective. He wanted to know whether it was possible to eradicate the disease once for all by Gammoxane spraying and if so the percentage of the solution to be used.

Shri Chandrasekharan suggested that the points raised by Shri Mitra might be discussed with him later.

Referring to the question of immunity of cattle against warble menace, the Chairman stated that by administration of drugs like D.D.T. and Gammoxane had been tried to some extent for the elimination and control of warble larve while they were inside the body of the animals. But there was what was called the cumulative poison ; the constant use of these drugs would do harm to the animal. Experiments were being conducted in America and other countries in this direction. He himself was conducting some experiments by oral administration of Gammoxane to goats for control of ticks and warbles. They could not go on introducing the drugs inside the body of the animals without taking into account their cumulative effect later on.

The Chairman said that he was not against the method of dipping but had only said that under present conditions it was not practicable. Powder spraying had been tried by putting it on the back of the animal,

Powder spraying had been tried by putting it on the back of the animal. It was no doubt useful thing but was not feasible under the conditions now obtaining in rural areas.

The Chairman then explained in detail the results of experiments conducted by him with regard to *Huntrellus hookeri*. The results showed that the optimum temperature varied from 18 to 22 degrees (Centigrade) and humidity from 75 to 80%. On that basis they had evolved a scheme to produce that parasite on a mass scale, but no final decision had been taken about the type of containers to be used.

At this stage, at the request of a delegate, the Paper on "Defects in raw hides and skins and suggestions for improvement" presented by the Director of Animal Husbandry, Andhra Pradesh, was read by Shri Roy Choudhury.

Dr. Nayudamma congratulated Shri Soni on the extraordinarily good work that he was doing in his Institute. He was grateful to him for having participated in the Symposium. He assured him that he would do his utmost to help him in coordinating the activities of the C.L.R.I. and the Indian Veterinary Research Institute.

He felt that some tangible results should be achieved through such Symposia and that they should formulate some recommendations or pass resolutions based on the discussions held. For that purpose they might have a small Committee to go into the salient features of the problems concerning the condition of hides and skins of animals during their life time and the curing and preservation of the hides and skins after their death and to study the problems with reference to Indian conditions, for exploring ways and means of arresting progressive depreciation in the commercial value of the Indian hides and skins. The Committee might make suitable recommendations for implementing the schemes for effecting an all-round improvement in the production of hides and skins.

Dr. Nayudamma suggested that the following might constitute the Committee :

1. Mr. W. A. Rutherford of Messrs. Gordon Woodroffe Leather Manufacturing Co. (Private) Ltd., Madras,
Chairman.

Members :

2. Mr. N. M. Anwar, Hony. Secretary, Southern India Skin & Hide Merchants' Association, Madras.
3. Mr. G. S. Srinivasa Iyer of M/s. Srinivas & Co., Madras & Vice-President of the above Association.
4. Mr. A. Nagappa Chettiar of M/s. India Leather Corporation, Madras and also a Vice-President of the above Association.
5. Mr. C. K. Duraivelan of M/s. Kalyanam & Co., Madras.

6. Mr. F. H. Hoek, F.A.O. Expert on Hides and Skins.
7. Mr. A. J. Sharman of M/s. Gordon Woodroffe Leather Manufacturing Co. (Private) Ltd., Madras.
8. Mr. B. R. Sen Gupta of M/s. Bata Shoe Co. (Private) Ltd., Batanagar.

(With Dr. S. K. Barat, Senior Scientific Officer, Central Leather Research Institute, Madras to assist the deliberations of the Committee as a non-Member Secretary).

Dr. Nayudamma suggested that the Committee might make their recommendations on the following points :

1. Improvement of Livestock.
2. Better care of animals.
3. Biological factors and control of pests and diseases.
4. Humane killing of animals and improvement of slaughter houses.
5. Utilisation of the bye-products of Slaughter Houses.
6. Improvement in flaying techniques.
7. Processing and Preservation with particular reference to wet salting, dry salting, pickling and brining.
8. Cold Storage.
9. Radiation techniques.
10. Use of preservatives.
11. Quality Control.
12. Transport.
13. Co-ordinating the activities of various Governmental organisations.
14. Dissemination of technical knowledge and ideas.

The proposal for the appointment of a Committee was accepted.
Shri S. M. Bose proposed a vote of thanks.

TECHNICAL SESSION No. IV.

Saturday, March 30, 1957.

9-30 a.m. to 1 p.m.

The fourth technical session of the Symposium was held at the Auditorium of the C.L.R.I. at 9-30 a.m. under the Chairmanship of Dr. Bertie A. D'Souza, Principal, Government Veterinary College,

Madras. Shri R. Bhaskaran introduced Dr. D'Souza to the delegates and proposed him as the Chairman.

The following papers were then read :

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| 1. Notes on Raw Hides & Skins from Picker Manufacturers, Point of View. | S. G. Desai, Ahmedabad (Pickers Ltd.). |
| 2. Flaying, its present position and some observations. | F. D. Wilson, Dept. of Flaying & Meat Inspection, Madras Veterinary College, Madras. |
| 3. Economic utilisation of carcass utilisation. | F. H. Hoek, F. A. O. Expert to the Government of India. |
| 4. Bye-products from the slaughter houses and their utilisation. | Dr. L. Hira, Supdt. of Markets & Slaughter Houses, Bombay Municipal Corporation. |
| 5. Economic Utilisation of Carcasses in India. | N. Haq, Hide Development Officer, U.P. |
| 6. Production of hides & skins | Dept. of Industries, Govt. of Orissa. |
| 7. Salt curing of fresh slaughter house hides. | V. P. Pandit & Y. V. Lele, Western India Tanneries Ltd., Bombay. |
| 8. Investigation on the preparation of neatsfoot oil. | M. Banerjee, Supdt. & P. K. Sircar, Liaison Officer, Bengal Tanning Institute, Calcutta. |
| 9. Products of slaughter houses and their uses. | S. Venkataraman, C.L.R.I., Madras—Taken as read. |
| 10. Some problems relative to the raw hides and the suggested remedies. | Do. |
| 11. Recommendations of the Committee. | Mr. W. A. Rutherford. |

Discussion :

Initiating the discussion, Dr. Nayudamma said : " I should first say how grateful we are for the excellent papers presented this morning. There is a lot of good ideas packed in these papers and I should certainly welcome more papers of that order and I also very much wish that some of the delegates that have come here may see the activities of the Central Leather Research Institute and get in touch with the research workers who are experienced in their own field of research.

While I appreciate the excellent work done by Mr. Wilson of the Veterinary College, Madras, on flaying, my question is how many of the 360 people that have obtained certificates in flaying are actually in the business and whether the business is actually utilising the trained personnel.

I have got a question, to be put to Dr. Hira, on the utilisation of the bye-products of the leather industry. The leather business starts and ends with money and the bye-products have become the indispensable part of the industry. We have taken steps in our Institute to utilise the bye-products. We want you to come and see the products manufactured from these bye-products and the economics of the processes developed in this Institute. If such a set-up is already there, I think that by seeing this for yourselves, you can see how practical it would be.

Mr. Kishore :

“ The iodine value of Neatsfoot oil prepared at the Bengal Tanning Institute is reported to be about 32 whereas what I get here is about 54 or so. I request, that in the absence of the author (Mr. Banerjee) any member of the audience may clarify.

Secondly, the cost of the hoofs or hooves and bones is Rs. 50 per 100 lbs. and we get only 5 lbs. of oil per 100 lbs. of bones, i.e., it costs Rs. 5 per lb. of neatsfoot oil, which is prohibitive. Could some means of getting these bones at cheaper rates be suggested ?”

Mr. Nandy :

“ This is not a question in regard to any particular paper but a request to the respective authorities. It is known that after flaying, the hides and skins are highly contaminated with impurities like blood, dung, etc., which definitely favour and stimulate bacterial growth. So the washing of hides after flaying is of utmost importance. But from my practical experience, I have seen in slaughter houses at Calcutta and Madras that the hides are washed very carelessly ; this allows the hide to retain sufficient amount of blood and other materials. Moreover, the water used for washing is not fresh and clear and contains lots of harmful organisms. So, it is my request to the authorities of slaughter houses to take proper care in this direction and thus help in keeping the quality of the raw stock.”

Mr. Bhaskaran :

(i) With regard to Arsenification of Hides, I am desirous of knowing the actual duration of time for which the hides have to be dipped in sodium arsenite solution, so that it may prove quite satisfactory in preventing insect damage.

(ii) With regard to the use of Naphthalene, would it not be better to use the recently developed chlorinated hydrocarbon insecticides in the place of Naphthalene ?

Mr. C. V. Gangal :

I request Dr. Hira to give us a general idea of the modern slaughter houses proposed to be constructed by the Bombay Corporation in the

near future. The slaughter houses in Bombay State are at present selling blood etc., as manure worth about Rs. 100. This is not a modern way of making a manure.

The second point is with regard to Mr. Haq's paper. The bone meal from the slaughter houses are sold at As. 2½ per lb. Some firms are curing bone meal along with other manures. I would ask Mr. Haq whether this bone meal could be used for some other purposes.

R. Selvarangan :

"In United States, hides are bye-products of the meat industry and so, flaying, salting and piling are done by experts in the line. In India, the set up is different. We get hides from aged cattle. They are ill-fed and the hides we collect are mainly from fallen animals and the collection is from throughout India. And hence, I do not understand why the emphasis should be laid only on the curing of hides in slaughter houses. Further, it is a difficult task to train the Mochis and Chamars to use a definite amount of salt, soda ash and disinfectants. It will take time and it is a long term project. Even if the Mochis and Chamars use good salt etc., the small scale business people will not give a high price. Therefore, they are interested in using substitutes for salt, usually, mud containing salt and urea. Therefore, why not we consider the question in a proper sense, i.e., recurring of the country-cured hides. Bacterial damage to the country cured hide can be stopped if we take proper steps to collect and recure them by having curing factories—one in Madras and another in Calcutta and a third in Bombay. These factories will receive the hides which are cured—properly or improperly—in the villages through the business people and also the fresh slaughtered hides; they will clean and dry them in a current of air at controlled temperature and humidity. Therefore, after drying, hides could be kept in a chamber filled with nitrogen, or any other gas so unfavourable to the growth of the bacteria as to kill them sometimes within 24 hours. These hides can be further graded, nicely packed and disposed off directly to the tanners or through agents for export hides cured in this way may stay without deterioration for a long time I would like the experts in the line to ponder over these points."

Mr. Wilson :

I thank my learned friends.

With regard to the number of butchers employed in Madras after training in our College, 152 butchers have been employed in the slaughter houses not only in Madras but also in the mofussil out of the students trained last year. The Industries Department has appointed two of my students as their master flayers, one in Tinnevely and another in South Arcot. I request not only the tanners but also my friend Dr. Nayudamma to help my students in getting employed after training.

It is our good fortune that Mr. Hoek and Mr. Haq are doing a good amount of work. I had the opportunity of seeing the utilisation of carcasses. I thank Mr. Hoek and Mr. Haq. Mr. Das Gupta has written about 6 or 7 books on cow hides in India and the carcass industry, in 1943 or so.



Photograph taken on the occasion of 'At Home' with
Shri K. Kamraj, Chief Minister, Govt. of Madras, as the Chief Guest.



Shri M. A. Muthia Chettiar, Raja of Chettinad, addressing on the
occasion of the 'At Home' on 29th March 1957.

Mr. Rutherford, Gordon Woodroffe Co. :

Just a passing observation on the matter of flaying. I think it is a very good idea to train these men properly in flaying. They must also be supervised whether they do their work properly. I do not think this is properly done today. Otherwise, it is all a waste of time.

Mr. Haq :

My friend asked me how I am disposing off the bone meal from my Centres. I am not finding any difficulty at my centre. The Agricultural Department of the State Government has taken full responsibility for purchasing all the bone meal and I feel if all the State Governments participate in purchasing the bone meal produced at the flaying centres, there would be no difficulty in disposing off these.

I do not quite agree with the view of the Gordon Woodroffe representative that the trained flayer is not doing his job well even after the training. This is not correct. I have done some work in the slaughter houses as well and I feel that the butcher flayer must get something more than what he is getting at present and you want him to do this job properly. Actually, to overcome this difficulty, I suggested to the government that the butcher flayer should be given some premium on the flayed hides. So actually I was paying 1 anna per hide for firstclass hides $\frac{1}{2}$ anna per second class hides and 1 ps. for III class hides. The result was every week I was distributing about Rs. 50 to about 20 flayers working. They were doing their duty very well. So I would request the big tanners, big hide merchants and others to arrange in such a way that the flayer may get something for the good work you want him to do, and to come forward and help the government organisations to get good quality hides.

Dr. L. Hira :

I entirely agree with Dr. Nayudamma regarding the utilisation of the bye-products. So far as the Bombay branch is concerned, we propose to instal a series of Western types of slaughter houses. Our object is to have something like a big colony here. We have cleared 130 acres of land. Some may ask why we require 130 acres of land ? The idea is, to provide at least assembling arrangements. All our live-stock come from rural areas. We want to get these attached to the slaughter houses. We also want to put up a cold storage room for preserving raw hides. We are also planning to put up a plant for converting the bye-products like bone meal into fertilisers, to be used in agriculture.

Mr. Hoek :

With regard to the question raised by my C.L.R.I. friend, I wish to point out that the arsenification method followed is the same as that in Malaya. The hide is dipped with the frames for one to two minutes in the arsenic solution in the fresh state.

With regard to naphthalene, it is easier to be distributed and spread on the raw hide than benzene hexachloride. This can be distributed in the powdered form as is done in Africa.

As regards blowing, the carcass which is blown out gives a better appearance than the one which looks diseased.

I personally feel much impressed by the symposium, and I think this is a new feature in the hides and skins field. I wish the Institute more and more success.

‘ AT HOME ’

The Central Leather Research Institute was ‘ At Home ’ to the delegates on the evening of 29th March 1957, with Mr. K. Kamaraj, Chief Minister, Madras State, as the Chief guest.

Dr. Y. Nayudamma welcomed the Chief Minister and the delegates participating in the symposium.

Speaking on this occasion Mr. M. A. Muthia Chettiar, Member of the Executive Council of this Institute referred to the extraordinary good research work being done in the Institute and said all the tanners had been benefited by it.

Mr. N. M. Anwar wanted the Government to take more interest in the leather industry which was earning foreign exchange needed for the development of the country.

Mr. C. K. Duraivelan paying a tribute to the Institute said that Dr. Nayudamma was continuing the good work done by the late Prof. B. M. Das and has made the Institute an “ Open House ” for those engaged in the trade.

Mr. A. Nagappa Chettiar wanted tanners to give their co-operation to the authorities of the Institute and thereby help the cause of the industry.

Mr. B. R. Sen Gupta of M/s. Bata Shoe Co. (P) Ltd., on behalf of the delegates thanked the organisers of the symposium.

Describing the leather industry as a “ hereditary industry ” Mr. Kamaraj, the chief guest, said that leather was now being made use of in many spheres of life and therefore, it had become necessary that improved techniques should be adopted by those in the industry. In this context, he also pointed out that if such industries were organised on proper basis, employment could be provided for more people and thereby their living standards could be improved. He assured that the Government would take all possible steps to promote the industry. At the same time, he wanted those in the trade to bring to the notice of the Government their problems and give suggestions for developing the industry.

Mr. Kamaraj congratulated the Institute for organising this symposium which he said should afford scope for people in the industry to make suggestions for its development.

Dr. Y. Nayudamma proposed a vote of thanks. The day's proceedings were rounded off with a dance recital by Kumari Rita Das, member of the staff of the Institute and her party.



Kumari Rita Das giving a dance performance on 29th
March 1957.

Remarks of Dr. Bertie A. D'Souza, Principal, Veterinary College, Madras, at the end of the Symposium on Raw Hides and Skins, on 30th March, 1957.

The Chairman in the course of his concluding remarks said :

“ What strikes me most is this : In this country, 85 % of hides and skins are from fallen animals and only 15 % are from slaughtered animals and a good deal of harm is done to the hides by ticks, warbles and diseases ; good leather cannot be produced from bad hides. I am not quite convinced whether we have examined the reasons for that. To me it looks that some years ago when the slaughter houses were coming into being, they said quality of the hides was good. Today, the legislation against the slaughter of animals is coming into force. I, therefore, ask the scientific personnel trained in an Institute like this, to deal with these problems, realising fully its importance with regard to earning foreign exchange.

The gentlemen from Bombay who is frank in expression referred to the idea that it is better to shoot or kill the animals than to make them suffer. I am sorry that this is not the attitude taken by the butchers.

Next is about flaying. As Mr. Rutherford pointed out there should be some supervision over the work of the trained flayers. We have got a number of slaughter houses and if we have to get licences to the workers in the slaughter houses, it would be a difficult problem. I am sorry that many of the trained men are unemployed ; a good amount of money has been spent on them.

Another important problem which strikes me most is the economic utilisation of carcass. We are trying to solve this problem in the South.

In regard to proper flaying, the best way of doing that is to try with a fairly good collection. Now you have got the Community Development Centres and other National development centres where you can centralise the affair.

The gentleman from Orissa said that most of the chamars are going in for other occupations, since the industry is not organised. The same position is there with regard to other industries also. With coordinated effort and by training some more men and given proper encouragement, this problem may be solved.

Dr. Hira has indeed given a very vivid picture of the various States which could be developed by this industry. He also has pointed out that we, in this country, look upon cattle and sheep only as animals for work and for milk unlike in foreign countries, where they are looked upon as animals for their food. So, to that extent, we should show some interest in the animals.

I must particularly thank Dr. Nayudamma for having given me this opportunity to participate in the Symposium and to hear the different papers read. There are many other points raised for discussion, which I cannot answer at this time. All the same, I must say that in Animal Husbandry Department, hides and skins form one of the

most important and most lucrative part and it is indeed the function of the Animal Husbandry Department to improve this industry to the maximum and to do their utmost to explore the potentialities, of improving our national income through this industry, which, as everyone of you knows, fetches a lot of foreign exchange. With the willing co-operation and help from the Central Leather Research Institute and with the increase in scientific knowledge by the valuable researches conducted at this Institute, I am sure the work of the Animal Husbandry Department will become hundred-fold.

Concluding remarks of Dr. S. K. Barat.

In summing up the proceedings of the Symposium, Dr. Barat referred to the rapidly deteriorating situation regarding the quality of hides and skins in India. In view of the fact that hides and skins as such and in the form of tanned leathers play an important part in the national economy and are responsible for earning a substantial portion of our foreign exchange, he felt that time had certainly come for re-examining the whole question of improvement of raw hides and skins in the light of newer knowledge gained by experience and research. He further observed that the crux of the problem relating to the immediate improvement of Indian hides and skins concerned the processes of their flaying, curing and preservation. The papers presented and the deliberations that followed, he added, singularly portrayed this aspect of the problem vis-a-vis the condition prevalent in different parts of India. In this context, he pointed out that attention should be immediately focussed on the eradication of extensive damage caused by warble, beetle, ticks etc. since it was estimated that approximately 10 crores of rupees are annually lost to the country due to defects which could be obviated with a little more of care and caution.

In course of its general remarks regarding methods of slaughter etc. Dr. Barat particularly mentioned about the sickening state of affairs in most of our slaughter houses and underlined the necessity of studying this problem comprehensively so that the matter could be taken up with the authorities concerned at the earliest.

In view of the foregoing, Dr. Barat hailed the proposal for constituting the "**Indian Hides and skins improvement Society**" with the following terms of reference as a positive step in the right direction.

1. To improve the species of livestock by cross-breeding etc. and to promote better health among animals by eradicating diseases, pests, etc.
2. To collect old and useless animals and to found suitable animal homes at central places in the country.
3. To improve the technique of flaying and curing of hides and skins from slaughtered and fallen animals.
4. To properly utilise the carcass bye-products of fallen animals.

5. To assist the villagers to obtain the best value for the hides, skins and offal from the carcasses which will encourage them to take better care of animals while they are alive.
6. To improve the method of collection and storage of fallen and slaughtered hides and skins.
7. To improve the existing transport facilities.
8. To co-operate with and co-ordinate the activities of allied organisations at governmental and non-governmental levels.

Shri N. S. Mani proposed a vote of thanks. With the singing of National Anthem the Symposium came to a close.

**General remarks on the future development of the
Indian Tanning Industry with special reference and
suggestion for a Hide Improvement Scheme.**

J. J. WALTERS

Guildford, Surrey, England

Having spent over thirty years in the Leather Trade and having used mainly Indian raw material for the production of various types of Light Leather, it has always been my wish to see your country and gain first hand information on various aspects of the Leather Industry.

I had the privilege to come to India last year and was able to form certain opinion and feel very pleased and honoured to have been asked to express my opinion and put certain suggestions before you. I regret that I am not able to deliver these personally but hope that this paper being read by someone else will contribute to mutual understanding and benefit the Indian Tanning Industry.

The raw material which the Indian as well as other countries in the world need are both hides and skins. India is in the fortunate position to have these as a natural product in great abundance. It is one of the most important raw materials India has exported in the past and is at the same time a raw material which India must cultivate to use successfully for her own home Industry. In particular skins, that is Goat and Sheep skins, have been exported both in the raw as well as in the half-tanned state in considerable quantities. It is not, however, realised by many people that Indian skin production is about one quarter of the world's skin production. This is indeed a very notable fact and is worth giving some thought how this great wealth of a very valuable raw material should be used to the best advantage. The annual production of Goat skins has been estimated recently at about 21,300,000 skins and the one of the Sheep skins at about 15,500,000 skins. The far greater majority of these skins, about 90% are exported and only about 10% are used for the production of finished leather in India according to the latest estimates available. Even if this figure is not an absolute up-to-date figure, and the proportion has changed even to 75% exported and 25% home produced, which I am sure it has not up to the present, there is no reason to become alarmed in India that there will not be enough skins available for the home industry or to be alarmed in overseas countries that not sufficient skins will come forward for export. India will have to go a long way to absorb these enormous quantities and to turn them all into finished leather. As much as I endorse India's right to develop her own leather industry and produce the leather which she will need herself in ever increasing quantities to satisfy the better living standard of her people and to produce also leather for the export markets, we must not forget that the finished leather which is required for various purposes in Europe as well as in the United States is very much required to produce fashion articles and quality goods of the highest order. As far as fashion goods such as shoes, gloves and leather clothing are concerned, the U.S. and European

tanners have already their own difficulties in producing the right goods at the right time. Fashions from suede to grain leather and colours change with such speed that it is sometimes difficult enough for a tanner in Europe to change his production at short notice and to avoid being left with unsaleable stock. I cannot emphasise this difficulty enough to the Indian tanner if he is thinking of producing "Glance Kid" or even "Shoe Linings" for the U.S. or European market.

Normal shipping times as well as shipping delays can mean absolute ruin to a tanner if his goods arrive at a time when fashion changes have taken place.

As to the production of high quality goods the competition of firms with established experience of the highest standard will be a great disadvantage for some time to come.

I believe therefore that the Indian Tanner would be wise to concentrate on producing in the first instance for the home market, and should only think of exporting leather which is not liable to fashion changes. I personally see a greater danger for the Indian Tanning Industry in their drive to establish "Glance Kid Industry" on a large scale than I can see any serious competition for the European and in particular the British Tanner. During my experience in the trade, I have seen myself that "Glance Kid" suddenly went entirely out of fashion, and tanners in this particular line had a very difficult time indeed.

Some kind of consultation and co-operation between Indian tanners and European tanners or consumers could only be of mutual benefit.

More important than anything else however seems to me the question of handling, collecting and preserving the raw material on which the Tanning Industry as well as the Export shippers depend.

As a casual visitor to India it is obvious and rather alarming to see the waste of this valuable raw material taking place, although some attempts have been made by the F.A.O. Expert in the U.P. State to put the raw skin industry on a scientific level and to control this part of the basic industry, it seems that no serious attempt on a large scale has been made by the Indian Government to tackle this important question of Hide and Skin Improvement. There is no supervision of the flaying and preparation of the skins. The quality of skins could be improved considerably if more, or at least some care would be taken with this very valuable raw material.

An improved raw material would give the Indian Tanner a better product to start from and at the same time increase the value of the skins which are exported either in the raw or as half-tanned leather.

I believe that money and energy spent here would pay the Government high dividends.

While it might be difficult to organise the proper handling and collection of skins from the villages and very small centres in the beginning, a start should however be made in the small and large towns

where slaughtering is done in slaughterhouses. Even the skins originating from slaughterhouses of very large cities could be considerably improved in quality if some authority would supervise the source of the valuable raw material. I have been told that even in the big cities the slaughtering of the animals is done in presence of the other animals and that they are kept in small dens near or sometimes even inside the slaughterhouses overnight. The animals are so frightened by the smell and the sight of the already killed animals that their blood is at a very high pressure which makes their veins swell just before they are killed. This is the reason for the very pronounced veins in the skins, a fault which causes great concern to all suede dressers.

How important it is to control and therefore improve the handling of the skins I have seen myself in one of the towns where for instance the procedure was the following : The animals which arrive from the neighbourhood in cattle trucks in very cramped conditions are driven to the slaughterhouse where they are locked in dens and remain there without drink or food until they are slaughtered. Slaughtering takes place at midnight. Flaying is done immediately and the skins remain in heaps on the floor. The skins are then transported by bullock carts or hand trucks at about 7 a.m. to the local market square where they are again piled in heaps representing the various lots ready for auction. This auction takes place at 11 a.m. and in the meantime the skins are open for inspection by the skin merchants. While this takes place the skins are lying in the blazing sun without any protection. Even after the skins are sold they are not often collected for a further two or three hours until they reach the compound of the merchant who will now salt the skins. No doubt a lot of putrefaction could be prevented here and valuable raw material be preserved. Any Government with an eye to the economy of the nation should not allow this waste of a commodity which is at present one of their main exports and is also regarded as an important raw material for the development of the future home industry.

A sound skin improvement scheme sponsored and supported by the Indian Government is necessary and would as I mentioned before not only benefit the home tanner but would also produce a higher value of exports which would benefit the Government in their trade balance of higher exports.

During my visit to India I have seen the short comings of the olden times but I was pleased to see the achievements of the New India and have felt the spirit with which this new India is being built. I know that the first Five Year Plan has fully met the Government's expectations and that in many cases higher levels than anticipated were reached. I feel sure that the Second Five Year Plan will be equally successful and hope that the Leather Industry will find all consideration within its scope.

Under the Second Five Year Plan great irrigation schemes are being carried out which will increase India's agricultural areas and no doubt will give better feeding facilities for goat and sheep. This will result in an even large production of skins which at the same time should also become of better quality.

This Five Year Plan also provides for improvements in animal husbandry and veterinary services are extended in all rural areas to

fight disease and to assist and introduce new breeding methods. All this can be great benefit to all users of Indian raw skins.

By providing better roads and transport facilities under the Five Year Plan the collection of skins from villages and rural areas will be speeded up considerably. This again should have great effects on improving the quality of skins. I consider lack of suitable transport facilities the main reason for the low quality of most Indian skins. The non-existing road communications make it impossible for experienced skin collectors to reach the very often large supplies of skins, which are now carried in badly preserved state over far distances by bullock cart, before they are properly cured by experts. What difference road transport would mean one can only imagine if one has seen the waste which is now going on by submitting this valuable raw material to the most unsuitable conditions.

I suggest therefore as a matter of great urgency and importance for the industrial and economic development of India that the Indian Government should launch a Hide and Skin Improvement Scheme on the following lines :—

1. Supervision of flaying the skins.
 - (a) In towns where slaughter-houses exist.
 - (b) In villages and small towns at communal centres.
2. Better treatment of skins, immediate preparation and collection.
3. Introduction of new curing processes.
4. Collection and distribution of skins.
5. Marketing control of skins.
6. Establishing of quality standards and price supervision to create confidence among buyers.

To carry out such a scheme an organisation which covers the whole of India should be created with the task of having representatives wherever skins are produced. This organisation should not only have Government support but legislation should be introduced to give this organisation the necessary powers to see that methods introduced are also carried out effectively.

As there are a great number of students unemployed in India or who are sometimes doing clerical work in offices and feel rather frustrated, I would suggest to utilise these students for the working of the scheme as their intelligence and scientific understanding could be most valuable and the work would give them much scope and interest for many years to come.

Only if it is possible to control and improve the basic raw material of the leather industry will it be possible for the Indian tanning industry to flourish and produce leather of a higher standard.

Before concluding I should also like to say a word about the newly instigated Leather Export Promotion Council. This newly formed

body is doing the right task if it will endeavour to establish representation abroad which will bring about mutual understanding and guarantee the quality of Indian exports. It should be clearly understood by the Indian tanner and exporter of raw materials that only reliability and quality will open to them better export opportunities. To see that this achieved, I consider one of the main tasks of the Leather Export Promotion Council.

I hope that the suggestions made by me in this paper will be useful and that they will promote also mutual understanding and trust which is so important these days to further happy international relations on which so much depends the well being of all the people in the world.

Collection of Raw Goat Skins in Co-operative basis.

R. V. SOVANI

India has a largest stock of animals, and producing 16 millions of cow hides, 5 millions of buffaloes hides, 22 millions of goat skins and 14 millions of sheep skins. Due to development of the leather industry and due to partition we are not exporting raw material, but we are importing raw material from foreign countries except sheep and goat to feed our tanning industry, due to introduction of the ban on cow slaughter in many states in the country, the available quantity of raw material is inferior. Hence it is very difficult to produce good quality of upper leather, especially from dead cow hides. Naturally tanner has to find out other raw material to replace this; so two ways are left to him. One is to import and other is to find out the substitute for the same, in our own country. Naturally he can put his attention to his exporting raw material—goat skin.

India, is one of the largest producer and she can produce a good quality of upper leather—Glacelid instead of exporting goat skin to other country. Our raw material—goat skins are famous for fine grain and for good structure. But in foreign countries now a days our goods quality is lowering due to adulteration and deterioration. Most of the raw material is exported in dry salted condition. Flaying and curing is not scientific compared to advanced countries like America, England and Germany if the quality of flaying and curing is improved we can increase the standard of goat skin and we will get good foreign market.

India, is a land of villages, naturally skins are collected in villages and also through slaughter houses of the cities. The city slaughter skins are comparatively better than the skin slaughtered from villages. The village butcher or flayer methods of flaying are improper due to lack of tools, experience and practical knowledge of flaying. He has more devotion to mutton than the skin. The large number of skins are cured with salt-salish mud, sand etc. These skins then collected by skin collectors from various villages are sent to big cities for sale or for processes. Due to this, large quantity of raw material is spoiled in villages by improper flaying, curing, inadequacy of transport facility and also keeping in damp condition in godown. Naturally the local tanner in our country and foreigners complaint about the adulteration, improper flaying and curing. These are some of the reasons of deterior-

rating quality of the skin. In addition to this skins are damaged due to insects diseases poor care and due to ill feeding etc.

The Central and State Government agriculture and veterinary departments, various tanning institute, small scale industries, F.A.O. expert and A.I.K. & V.I. Board and various other boards, and central research institute are devoting more attention to improve the quality of our raw material. Addition to this responsibility rests on the producer of the raw skins.

A.I.K. & V.I. Board has sponsored the scheme for the flaying, curing, and utilisation of flesh and bone etc. The scheme, so to say is an experimental stage more over it is guessed from the scheme that improvement in respect of flaying and curing can be achieved. We will get good result from this scheme in near future. Addition to this the proper knowledge of flaying is given if these skins are collected at one centre in raw i.e. a nice preservative state it will give improved raw material, this can be done by the following methods.

(1) Helping individual butcher and flayer.

(2) Starting collection by government.

(3) Forming a co-operative society under the control and technical help from government or recognised body.

Out of these, individual help is impracticable as there is a shortage of raw material at villages and there is also less scope at one village. Starting collection by government will not help to improve the industry as it will provide employment for a few only and there will be no organisation of the industry, instead of government can make the gradation of the quality of the material. The only formation of the co-operative society under the control of government with the technical help is more suitable and this can help to raise the standard of the raw material.

Co-operative societies can be conducted in the following way as there is insufficient supply of raw material in the villages, so these societies may be situated for five to six villages or for twenty-five to thirty-five miles area—and this may be attached to co-operative tanneries if raw material is insufficient to run a separate society. The society may be given facilities of collecting raw material, salt and other curing material transport, godown other implement like boards, frames, toggles, knives etc.

At present the quality of goat and sheep are some what better than the hides but with the modern technical knowledge of flaying curing and preserving, collection will be produce better quality of raw material and this will also help to preserve our fallen animal hides in villages so this will help to improve our dead hides.

The systematic adoption of collecting skins with scientific methods of flaying and curing will help to improve our raw material and this will help our leather industry to fetch more money in home and abroad. This will also help to change the economic and social life of butchers, flayers, chamars, in near future.

Note on collection of raw hides and skins and suggestions for improved methods.

DR. L. M. HIRA

Superintendent of Markets, Greater Bombay

Hides and crudely tanned leather have been in use in India, since time immemorial. Besides boots, shoes and leather clothing, 'Pakhal' and 'Mashak' are some of the ancient gears, made of leather and hide, which the water-carriers even now used in many parts of the country.

A great majority of hides produced in the country are obtained from fallen animals which die a natural death. On account of religious, economic and other reasons, comparatively small scale slaughter takes place in the Municipal Slaughter Houses where too, generally old and unserviceable animals are slaughtered.

Before the world war II quite a large number of horned cattle used to be slaughtered but now partly due to the partition and partly as a result of the stoppage of slaughter by legislation in some areas and restriction of slaughter imposed on certain categories of cattle, the production of hides has been progressively going down in this country.

The quality has also considerably suffered as poor hides with warbles, tick marks, brand marks and other defects due to the old age and the emaciated condition of the animals before death, are retained by the 'chamars' and others for tanning in the village. It is, therefore, not only essential to improve the quality of hides retained in villages, but also the method of tanning prevalent there. Otherwise, this ancient village industry will gradually die out, causing a great economic loss to the country as a whole.

Preparation for market really commences with the flaying operation, i.e. taking the hide off the dead or the slaughtered animal. In many foreign countries, mechanical flaying machineries are employed in the operation whereas in India the flayers use knives only. Haste on the part of flayers, the employment of inexperienced flayers, the absence of hoisting arrangement, ill-kept slaughter houses etc., are responsible for causing many cut and flay marks on hides. In many cases too much flesh is left adhering to the pelt, which render preservation ineffective and the loss to the country due to defective flaying is considerable. It is, therefore, suggested that apart from improving the condition of work and the adoption of other preventive measures, the payment of suitable premium to the flayers be tried, for properly flayed hides have proved effective in reducing the number of flay cuts.

The next step in the preparation for the market is the curing of hides. Common salt has been the best and the cheapest material for use in curing hides. It should be pure and clean to get the best results from curing. Its uses, however, has been rather limited, specially in the rural areas, as the producers being mostly poor, are not able to afford it. The production of hides in the country side is also not only scattered and on a small scale but also casual and irregular. Thus

the assembling of hides has to be done on a wide spread but piece meal basis, much to the disadvantage of the producers as no marketing facilities exist in these areas.

Standardization and grading

The quality of hides depends upon a number of factors, such as breed, sex and age of the animal, the time of death or slaughter the way the hide has been flayed, cured, stored, handled etc. The sorting of hides is, however, not generally practiced until they reach the large scale assembling centres where the Commission agents or big dealers assort them before sale. In the case of hides meant for export, all the specification including those of weight are given in what is known as the 'Hamburg classification.' This system has developed through mutual agreement between the exporters and the buyers abroad and is now a generally accepted basis of contract between them.

The statutory 'Agmark' specification were tried some years back on an experimental basis on the recommendation of the Indian Tanner's Conference, but it was found that tanners and shippers were not interested in the grading of hides at the Slaughter Houses even though it was accepted by all concerned that the flaying of hides improved to a great extent wherever grading was done. The probable reason was that small units of graded hides not being available in sufficiently large quantities, failed to attract large buyers.

Now that the slaughtering in the country is being prohibited or restrained, the tanning industry in India will have to depend more on the hides produced from the dead animals. These hides being definitely inferior to those obtained from slaughter houses, it would be essential to sort them out into different quality-groups before they could be profitably used by the tanning industry. Unless the standard of quality of the dead hides can be raised to appreciable extent, it may be very difficult for this country to produce good quality leather for better class of finished articles. It is, therefore, suggested that for improving the trade and also the quality of the hides produced in the country, the shippers, tanners and merchants should co-operate in evolving standards for Indian hides and resolve to trade on that basis only.

It is also suggested that Peripatetic demonstration parties consisting of expert curers, tanners and skilled technicians for imparting practical training to the indigenous producers should be organized with a view to train the village 'chammars,' shoe makers and others for making better class leather goods to meet the local and, if necessary, urban demand. It is very necessary that the continuity of these demonstrations be maintained till definite results are achieved.

So far skins are concerned, India produced the largest number of goat and sheep pelts in the world. The production of skins is intimately connected with the demand for meat. The universal practice of marketing Indian skins in mixed lots, without any regard to their selections, has resulted in a deterioration of the general standard of the quality of skins in this country.

In many cases, flaying is also carried out in haste and by inexperienced butchers with the result that such skins show flay marks or cuts or superfluous flesh on the belly or the butt. The extent of damage through flay marks and cuts is stated to be round about 10%.

The principal defects in the present methods of curing are faulty cleansing, under-salting, incomplete drying and over-stretching. All these defects lead to deterioration of skins and the annual loss to the country through defective curing alone may be reckoned at several lakhs of rupees.

In order, therefore, to improve the standard of quality of Indian skins, it is necessary to discourage the present practice of flat selling and insist on the marketing of skins on their quality factors only. This is, however, only possible in big cities and towns where the daily production is sufficiently large to be graded without any serious difficulty. Grading on co-operative basis in some concentrated rural areas of production can also be tried, but it would appear to be more feasible to have this done at the shippers and because the export trade in skins is vital to our country for earning much coveted dollars currency. Efforts should also be made to convert these skins into leather in the country before export. This will not only find employment for a large number of our countrymen but also fetch more money from outside.

Further to remedy the various defects and effect general improvement in the hide and skin industry the following additional suggestions are made :—

1. A set of instructions suitably illustrated on flaying and curing of hides and skins for the benefit of flayers should be prepared and printed in as many languages as possible.

2. A certain sum should be set apart by each State Government to encourage better flaying by payment of premiums to good slaughter house flayers. As far as possible only licensed flayers after proper test should be allowed to work in the municipal and other recognised slaughter houses and improved methods of flaying including use of flaying machines should be introduced at the large slaughter houses.

3. Co-operative Societies should be organised with a view to improve flaying, curing and also marketing of hides and skins cured specially by the indigenous producers. Curing methods should also be standardised.

Supply of quality raw hides and skins to Tanners' Co-operative Societies, etc.

C. V. GANGAL

*Tanning and Leather Expert, Industrial Co-operatives and
Village Industries, Poona*

1. Introduction :

Our country is said to be one of the richest countries of the world so far as animal wealth is concerned. We are harping on the same note for the last few decades that we are exporting so many millions of hides and skins every year and this industry is helping Government

in earning foreign exchange. Until independence, there had been very little or negligible development of the Tanning and Allied Industries in this country. However, in the past few years there has been surprising awakening in the masses and Government is paying top most consideration to this industry for all-round development as the industry has direct bearing on the amelioration of a major section of backward classes.

Recently the demand for hides and skins in the country itself is fast increasing and there is clamour all around, about the quality of raw hides and skins deteriorating. The associations of the persons in the industry and the publications thereof have warned that our country is bound to face acute shortage of raw hides and skins if immediate attention is not paid to utilise in the best manner the national resources in raw hides and skins. The cost of the raw hides and skins in our country is also said to be comparatively higher.

Government is offering financial assistance to revive the village tanning industry on co-operative basis and a stage would soon reach when the hides and skins of suitable quality may not be available except at key centres in the industry. It is a matter of pride that the Central Leather Research Institute has sponsored a symposium on the vital problem of the industry at the most appropriate time and we hope considerable momentum would be gained for having radical change in the near future in the present state of affairs, so far as supply of quality raw hides and skins to our trade is concerned.

2. Present condition of supply of hides and skins

Due to very limited slaughter of the animals, our country is mainly depending on the supply of hides and skins from dead animals more so for the heavy hides. Hence unless a revolutionery change takes place in the mode of flaying dead animals, treatment to raw hides and skins for perfect preservation and modern storing facilities at important centres, the industry cannot overcome the difficulty in getting quality raw material.

We have practically not valued the important role, that is played by utilisation of by-products of dead animal. If these are properly utilised, about half the cost of hides or skins can be reduced.

In various states, some sections of the backward classes have the hereditary rights to remove the dead animals from a particular locality. At places these are called "Vatans". The animals are flayed somewhere under the shade of a tree or by the side of stream in the outskirts of the town without special attention to cleanliness and proper flaying, preservation etc. The dead animal is often dragged a long distance; naturally what a tanner can expect from such raw stuff? The so called "Preserved" skins and hides with plenty of superfluous flesh, not to speak of smell, are sold to the middlemen or agent of a big raw hide merchant from a key centre of the industry. Most of the places where the hides and skins are stored are filthy and quite unsanitary.

The Gramapanchayats and Municipalities perhaps consider a dead animal as "waste" and they wash off their hands by giving contracts for a certain period and see that a dead animal is removed from the locality immediately.

Flaying centres are being organised under Government sponsored organisations but there are a number of practical difficulties in their implementation for want of full co-ordination from the civic bodies and health departments. A sort of inducement is also required at present for quality flaying and proper preservation of the hides and skins with a view to popularise the flaying centres.

Resources of a village tanners or their society are quite inadequate to enable them to store raw material and as a result they are dependent on the agents of big firms and a village tanner barely gets his wages because it is binding on him to sell his produce to the agent from whom he gets raw hides on credit.

3. Development schemes :

With a view to popularise the flaying centres and to ensure that most of hides and skins of dead animals are properly available for tanning industry, the developments may have to be based on the following requirements :—

(i) Two types of flaying centres may be designed suitable for District places or big Taluk places where there are transport, electricity and water facilities and for villages or small towns.

(ii) Provision for conveyance should be made for both these types of flaying centres. The bullock carts or station wagon trailers which carry the dead animals should be covered.

(iii) Suitable preservatives, drying frames and storing racks, etc. are necessary for every flaying centre.

(iv) Necessary technical staff may be provided for each centre.

(v) Quality flaying should be awarded prizes and the gradation of the material be standardized.

(vi) Provision should be made for utilization of various by-products at class I flaying centres, where as bonemeal should be the only by-product at class II flaying centres, other parts being turned to manure.

(vii) Proper co-ordination and control should be effected by the Municipalities as regards sanitation, inspection and necessary facilities. The centre should be located at an easily accessible place not far off from the town. It may be convenient to procure all the dead animals in about 5 miles radius from the flaying centre.

(viii) Utilisation of the by-products as fertilisers should be done under the control of Agricultural Department.

(ix) Flaying the animals at stray places and leaving the carcass in open place should be penalised. Before this, considerable propaganda work has to be undertaken regarding the benefits of flaying centres.

4. Finance

It may not be proper to expect these flaying centres to be self-supporting in the initial stages. Though it is possible after this movement gains necessary momentum, however, Government would be

prepared to subsidise these schemes adequately in the interest of the development of tanning industry.

The Co-operative organisations at district level or social organisations have to be adequately financed as the hereditary artisan has to be paid for the dead animal on the spot and considerable funds would be locked up in stocks of raw hides and skins.

5. Conclusion:

In the foregoing paragraphs attempt is made to bring out the practical difficulties in the development of this fundamental section of the tanning and allied industries. We all have realised the gravity of the problem through the hard-felt difficulties in the trade. It is therefore proposed that a committee may be appointed at this symposium to study the problems in details with a view to make suitable recommendations to the Government. With this, Sirs, I conclude expressing my gratitude for the opportunity given to me to give my views on the subject at this symposium.

Raw Hides & Skins

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India can claim to be the world's major supplier of hides and skins and it is reckoned that there are 140 million cattle, 41.5 million buffaloes 38.8 million sheep, 47.3 million goats which constitutes nearly one third of the Cattle and Buffalo population and one sixth of the sheep and goat population in the world. Cattle and Buffaloes are of great social and economic value to India which is predominantly an agricultural country and nearly 86% of the population is engaged in agriculture. For agricultural operations viz., tilling irrigation transport the major motive power available is the "Bullock." Since time immemorial the entire structure of the Indian agriculture is based on the cow which has been the centre of national economy.

Hides and skins are by-products of the agricultural and meat industries and as a result enjoys certain advantages and suffer certain disadvantages. The advantages are mainly in marketing. The value of the hide or skin will be roughly about 4% of the value of the main product. Any increase or decline in the price of hides and skins has no restraining influence over the raising of herds, by the stock breeder. Obviously price changes of by-products are of less importance to producers than those of primary products. The disadvantage is that hides and skins are producers on the living animal without exercising much care for their function in the leather industry. So much so animals are not bred for the sake of their hides and skins.

In view of this our immediate need is the development of cattle in our country. At present grazing is poor except during the monsoon periods and the available food is not in keeping with the growing needs of the population. There is an alround shortage of good bulls of known breeding quality and the growth of cattle is comparatively low. It is

said that Indian cattle possess undoubted potentialities for development and they will respond well if better methods of feeding and breeding are introduced. A good portion of our cattle is diseased and decrepit and the only solution for the prevention of the undesirable from further reproduction is the segregation of the good from the bad.

The total cultivated area in our country is estimated at 270 million acres in addition to another 70 million acres of cultivable waste. Each cattle on an average requires at least one acre of cultivated land to maintain itself and produce milk or work. Thus the 360 million people in the country are competing for their existence with 195 million cattle. The problem is still more acute if the other domesticated animals like sheep and goats are taken into account which have to share the available food with the bovine population.

It is a well known fact that a large number of milch cattle are annually slaughtered in big cities. The unhealthy and congested surroundings where these animals are kept destroy the breeding values of the cow many of which are sent to the butcher at the end of the lactation period. In turn fresh stock is imported and the result is a steady and continuous depletion of the cattle wealth of the country.

With all these handicaps India produces 16.1 million cow hides 5.1 million buffalo hides, 14 million sheep skins and 22 million goat skins besides 4.8 million pieces of reptile skins. Leather which must resist severe abrasion and strain is made from hides of cattle, skins of sheep, goats and reptiles and if fashion dictates an odd fish here and there. In the case of hides about 85% of the production is from naturally dead animals whereas in the case of skins 80% is from slaughtered animals. The raw material available are poor in quality due to a variety of reasons. The mechanical damages like scratches, yoke marks, goad marks, branding etc., and biological defects like warbles, ticks, the common pest, cause considerable damage to the hides. There is no estimate available of the annual loss incurred by the producer on this account, but it is an established fact that good leather cannot be made from bad hides, by the existing processes and techniques adopted by the Industry at present, and so the loss to the trade is enormous.

Flaying of hides is far from satisfaction and the annual loss due to this is estimated at Rs. 78 lakhs annually. Many hides otherwise good are reduced in value as well as utility due to carelessness in this operation. Knife cuts, gouges, etc. which are sometimes very deep indicate very bad flaying. In finished leather knife holes cannot be distinguished but if the leather is used for making small articles, such as boots, shoes etc., these can be tolerated by very careful cutting. For industrial leather that are subjected to strains, the tensile strength is very important. Presence of small cuts, makes it completely useless for the manufacture of industrial leather. It is the same in the case of case hides and upholstery leather. Much improvement is needed to improve the existing conditions and suitable steps should be taken to train flayers especially in villages, which contributes a major share in the production of hides. It is upto the Department of Animal Husbandry in the various States to introduce ways and means suited to the particular area for improving the existing state of affairs and avoid the great national loss.

It is not sufficient if a good quality hide alone is produced and it has to be preserved and transported carefully to the Tanning centres for processing. Several methods of curing are adopted, depending on the climatic conditions and the availability of materials used for curing. The producer should realise and co-operate with the Tanners by adopting proper methods of curing as otherwise the raw material gets damaged. A lot of suggestions are expected to be discussed at this symposium.

All said and done, finally comes the question of storage and transport which is an important factor affecting the quality. Raw Hides and skins are sometimes kept over long periods, under improper storage conditions. The damage may be due to dampness, heat or insects etc. The duration and the strength of curing depends in turn on atmospheric conditions, construction, and ventilation of the godowns, handling of hides etc. Due to these the hides develop hair slip and sometimes in very advanced cases, the hide becomes completely useless that it will be good only for manufacture of glue.

Very often cured hides and skins deteriorate during transit, in particular during the summer and rainy seasons. When transported by rail the steel wagon gets heated up and this affects the raw stock.

When all these considered, the loss incurred by this branch of the trade is enormous and at present no estimate of the loss is available. We hope that in this assembly of experts from the different sections of the Industry, we will be able to discuss the various item and suggest ways and means of improving the industry. Any damage that is caused to the hide or skin must be felt by the farmer, butcher, hide collector and lastly by the tanner, as the raw hides and skins account for over 50% of the value of the tanned leather. The agriculturist suffers indirectly being a considerable user of leather, in the form of footwear, harness, leather buckets etc., and therefore he should have a direct interest in ensuring the production of good quality leather free from defects. Unlike timber and food products, hides and skins do not reach the consumer in a condition which enables their origin to be distinguished, and for that reason it is not possible for him to exercise his voluntary preference.

Export of Goat skins

Calcutta Hide and Skins Shippers Association

Hides and Skins are a business which in all its various manifold aspects is probably one of the oldest trades associated with the commercial activities of the town of Calcutta. It never attained the same wide recognition abroad—nor for that matter in India itself—as jute, tea, shellac or similar raw materials. Probably this has something to do with the fact that the total value of the trade is not as big as other products, and also possibly because there are many other countries in the world producing hides and skins, which means that this article does not constitute a monopoly of India, and thereby does not attract such special attention like jute, etc., and in its time even indigo. However, hides and skins for many decades have contributed to India their fair

share as foreign exchange earners, and although the export trade has lost its importance since the export of hides and sheepskins was totally prohibited, it still remains quite a large business, providing a reasonably

steady, if difficult form of income to many thousands of people in the cities as well as in the remotest villages upcountry. And this, together with the foreign exchange, these days chiefly earned through the exports of the drysalted and wetsalted goatskins, makes it necessary that all concerned put forward a determined effort to keep the business on a sound basis and to do everything possible to improve the quality of the article and thereby keep it competitive with similar products of other countries. We therefore welcome the opportunity of presenting this paper at the Symposium of the Central Leather Research Institute.

As our association these days is concerned chiefly with the exports of goatskins from Calcutta, we will deal chiefly with the aspects of this particular article in the following.

Contrary to most other ports of export in India, the types exported from Calcutta are many and varied. The area from which the supplies are drawn, extends south approximately as far as the Mahanadi river, then roughly in a straight line north-west upto Banaras, from there, north to Gorakhpur, right upto the Himalayan foothills. Supplies originating from the borders of this boundary line find their way to other skin centres, like Madras, Lucknow, Kanpur or Delhi, if the demand in Calcutta is not good. But normally the goatskins that originate north and east of this boundary line come to Calcutta, and are sized and graded there according to the requirements of the export and local trade. Before partition, the skins from East Pakistan also used to come to Calcutta, and it is a great pity that area has been lost to the Calcutta trade, as the quality and sizes from the East Bengal area are very desirable, and normally fetch a premium of around 6%-10% over the prices of skins originating in India.

While the Indian skins are in some respects even superior to the East Pakistan product, they suffer from one great defect. They are infested with warbles, or pokhas as they are called in the trade here, which in some districts at certain times of the year cause such damage, as to make the pelt of the goat very nearly useless for producing a piece of leather for commercial use. A few areas in India, particularly those south of Calcutta and the northern areas of West Bengal are free of pokhas, but unfortunately the quantity of supplies available from these districts is comparatively small, and probably constitutes less than 20% of the yearly exports from the port of Calcutta, which average normally about 120,00,000 of skins. It is therefore all the more unfortunate that these areas which are free of pokhas are not free of other defects. Of course, this is something we must expect in any article of nature, where we always find some bad points and also some good points. Through selective breeding and proper care and attention, natural drawbacks can be gradually eradicated, but that is a process which takes a very long time, and therefore outside the scope of our present review.

Nobody, be it a private individual or an official, in this country, seems in the past to have taken much interest in placing on record the development of the hide and skin business. Little, therefore, is known from authoritative sources on how the structure of the trade developed

through the ages, until it achieved its present shape. However, in the year, 1953, the Directorate of Marketing and Inspection, New Delhi, made a serious attempt to organise the business on more uniform lines, and set up schedules dealing with the grading and siting of various types of goatskins exported from India. Those regularly exported from Calcutta and generally comprised under the term "Calcutta types," are the following :—

1. Wetsalted and Drysalted Kushtias.
2. Wetsalted and Drysalted Calcutta Kills.
3. Drysalted Indian Daccas.
4. Drysalted Maldas.
5. Drysalted Indian Dinajpores.
6. Drysalted Muzaffarpurs.
7. Drysalted Best Patnas.
8. Drysalted Ordinary Patnas.
9. Wetsalted and Drysalted Lucknow/Kanpur.
10. Drysalted Delhi.

All these types are suitable for the manufacture of Glace Kid and Suede, and the Square footage produced in lots of normal specifications ranges from about 36 sq. ft. to 50 sq. ft. per dozen. With the exception of the Kushtias, Indian Daccas and Maldas, all other types are infested by warbles (pokhas), and chiefly for this reason fetch a lower price than the types which are free of the pokha defect. The warble insects predominate in Bihar and U.P., but as the development of the road and rail net in India progresses, so live animals get transported from the infested areas to the industrial areas of Bengal where meat can be sold at higher prices and in recent years a progressive infection has been noticed in areas in West Bengal which formerly were quite free of the damage. It appears, that the parasites which are imported on the animals from the other provinces, get acclimatised to a certain extent in Bengal, and thereby gradually the area of infection spreads. It is undoubtedly necessary that the special Government departments pay careful attention to this matter of insect damage, as it not only affects the value of the hides and the skins for the leather trade, but also the general health of the live animals, and impairs the potentialities of producing healthy milk and meat for human consumption. It is obvious that an animal which is infested with blood-sucking insects cannot be in such healthy state as an animal that is free of such troubles. How much damage is altogether caused through warbles and other insects, is quite impossible to assess, but it must be tremendous. Other countries all over the world are making determined efforts to find means of destroying such pests, but unfortunately only with limited success so far. In India, research is carried on by the Veterinary Research Institute, Izatnagar, and we can but wish luck to the scientists who occupy themselves with this task, and hope they will meet with success in the not too distant future. As regards the loss in value of a skin that is affected by insect bites, we may say that it is in the neighbourhood of Re. 1 per piece. Assuming half the goatskins exported from pokha areas are infected, makes for a

loss in value roughly in the neighbourhood of Rs. 50 lakhs per year, possibly even twice as much. As already mentioned above, the skins affected by these pests mostly are those from Bihar and U.P., which are classified under the following name :—

Muzaffarpurs, Patnas, Indian Dinajpores,

Lucknow/Kanpurs, Delhis.

Unfortunately, the types which are generally free of pokhas, such as the Kushtias, Indian Daccas and Maldas, suffer a large proportion of cuts and flay marks, which of course are entirely due to the negligence of the butchers, chiefly in the villages, who regard a skin as a by-product, and therefore not worthy of much special trouble. Most prevalent areas for bad flaying are the districts of West Bengal, north and east of Calcutta, and the sooner Bengal authorities take an active interest in eliminating this defect, the better. Taking these three types as constituting approximately 20% of the total exports of goatskins from the port of Calcutta, gives us a quantity of approximately 24,00,000 of skins, out of which about half are damaged by knife-cuts to a greater or lesser extent, and thereby suffer a loss in value, which may be estimated in the neighbourhood of Rs. 10/12 lakhs. This is money thrown away through human carelessness. It is not an act of nature, like the warbles in the skins originating in Bihar and U.P. and therefore these knife-cut defects can be eliminated much quicker if proper steps are taken by the authorities.

When the Government of India applied itself with active interest to the goatskin export trade in 1953, the purpose was to improve the article through officially controlled grading at the ports of export. Fortunately the scheme was not pressed into operation. It can be readily understood that a skin once damaged cannot be made good again, and it is therefore logical that an improvement in the quality of the raw material must start first of all at the source of origin, namely, upcountry with the producer. It is the livestock of India, the oxen, the cows, the goats, the sheep and the horses that have to be more carefully tended during their lifetime and freed from parasites and human made defects, before the quality of the Indian hide and or skin can show a marked improvement and for purposes of leather manufacturing, qualify for better competitiveness and steadier demand in the world markets. An alround improvement is just as important for the indigenous leather industry as it is for the export of the raw material, because no Tanner, however good his process, can make a fine piece of leather out of a hide or skin which is damaged by knife-cuts or riddled with insect holes and other grain defects. As already mentioned, the Governments of other hide and skin producing countries are spending large sums of money to minimize such defects, and there should be no lagging behind in this country either. The Indian Tanner has repeatedly clamoured that the export of drysalted and wetsalted goatskins should be stopped, so as to provide the local industry with cheap raw material. What is the good of cheap raw material to the local industry when the raw material itself is not satisfactory. Leathers made out of inferior hides and skins are not going to enable this country to build up a new, permanent industry. Particularly in leather, the raw material out of which it is manufactured, still plays a very predominant part with regard to the

final quality of the finished product. Also, contrary to cow and ox leathers, the processing of goatskins in this country has not yet reached the point where it can compete with the foreign Glace Kid and Suede Tanneries. Therefore, if the exports of the goatskins in the unprocessed state were prohibited entirely and all skins tanned in this country, it would only mean that the best was not produced out of the raw material as it exists. And quite apart from that, the established Tanneries in foreign countries would not just close down and fade away, they would buy drysalted or wetsalted goatskins from other countries, such as Pakistan, China, East and West Africa, South America, the Red Sea countries, etc. India is individually the largest producer of goatskins in the world, but she has no monopoly for the article. An interesting sidelight on the fact that the Indian goatskin can be substituted by raw material from other countries, is the fact that exports to the United Kingdom have in recent years fallen off considerably and have been substituted by goatskins from other countries, namely, Pakistan and West Africa. If pokhas and flay defects could be eliminated or at least reduced, it would guarantee our skins a much steadier market overseas and at the same time, better prices.

As regards the preservation, most of the goatskins exported from the port of Calcutta these days are in the drysalted state. The means of preservation is Khari salt—a ground Salt, mined only in North Bihar. This Khari salt, whilst not an ideal preservative, is reasonably effective, and most Tanners in the world having got used to it, have adjusted their processes of manufacture accordingly. In former years, large quantities of wetsalted goatskins and also air-dried goatskins were exported, but both these methods of preservation are not as reliable and lasting as the dry Khari salt cure. They also have other defects, such as danger of hairslips, excessive bulk and weight, entailing extra freight in the wetsalted, and hidden putrefaction and susceptibility to dampness in the air-dried skins, also called flint-dried. Since Khari salt is dug out of the ground and utilised that way, without any chemical refining, the consistency of its ingredients varies to quite a considerable extent, and here is another point where the Government of India could usefully apply control. Apart from the natural variation in the percentage of the various chemical ingredients that make up Khari, the colour being dark or reddish brown, makes it easy for unscrupulous suppliers to mix in mud and thereby make an extra profit. That such adulterated salt does not possess the qualities of preservation it should have, must be obvious to everybody. Damage to pelts through unsound salt, happens quite often. Also, the question now arises for how long the supplies of Khari salt can continue in the future. We seem to have no information on the untapped reserves in the ground, like one would have for seams of coal or ores, and as far as we know, no survey has ever been undertaken. Whilst supplies so far have generally been readily available, it is perhaps just as well to start thinking about substitutes. If a chemical compound could be developed by the Government of India and manufactured in a State enterprise of a consistent quality and cheap enough to substitute Khari salt, then that would be a step in the right direction. As this country develops, the proper distribution of such a preservative should present progressively less difficulties. Many foreign manufacturer have already produced chemical preservatives for which they claim all sorts of advantages. The disadvantages are never mentioned. If an artificial preservative is created in India,

it is important that it should be uniform throughout the country, so that the Tanners both here and in foreign lands get to know it well and can adjust their processes accordingly.

Finally, we would like to draw attention to the wastage and loss which occurs in this country, through killing off goats before they have reached full maturity. Not only is there considerable loss of food in the form of meat to the country, but also the pelts are not so big and strong as when the animal is fully grown. There comes a time when the animal reaches its optimum, both for the food and the value of the by-products. This reached when the animal is fully grown and in its prime. Slaughter before or after that age means a waste in one way or another. The present-day requirements by Tanners all over the world are drifting away from skins of small sizes. Most of the goatskin Tanners prefer pelts between 3-5 sq. ft. Many can use larger, but few can profitably use the smaller sizes, which, therefore, fetch disproportionately lower prices in all markets. A goat from any district in India when fully grown, will produce a pelt with a footage from 3-5 sq.ft. In view of our rapidly growing population, it is upto the people in this country to make the best of the resources of raw material they can command, and it is the duty of the Government and of the people connected with the trade to help in the work, to the common purpose of increasing the well-being, happiness and prosperity of the nation.

Brining Process of Curing—its merits and demerits

S. C. NANDY, C.L.R.I., MADRAS

(A Review)

What is brining ?

It is a process of curing hides by treating them in saturated salt solution or brine. Frigorifico process of brining hides as carried out in South America have long been practised and such cured stock has been since long the source of standard raw materials in the Tanning Industry. Though brining is mainly followed in the United States of America only, the supremacy of this method over that of salting by dry salt is well recognized by a number of investigators in different parts of the (1-18) world. This process of curing by brining may produce some extra expenses over that of the traditional salting process but the additional advantages gained with it probably submit the reasonable ground for its adoption.

Frigorifico Process :

The actual process of brining may vary in different places even in different parts of America. The common frigorifico process may be described as follows :—

After flaying the hides are well washed and cleaned carefully with brushes in running water. These are then defatted on the flesh side as well as ears, lips, tails and legs are removed. The hides are then sorted according to weight and hung up to drain. These are then put in a concentrated brine solution of about 22-24 Be¹ for a period of 12-24 hours, making sure that the hides are submerged in the brine. During

soaking the brine is stirred and the concentration of the brine is restored by adding fresh salt. They are removed from liquor and allowed to drain. The hides are then piled, clean fresh salt being applied on the flesh side and left in the pile for about 30 days. Before despatching the hides are shaken and weighed.

A better process:

McLaughlin and Theis¹ in the year 1922 showed experimentally that hides if brined previous to salting with powdered salt, offered definite advantages over that if not brined. They obtained thicker and firmer leather of higher yield with the outstanding advantage that salt and iron stains were appreciably minimised. But he pointed out that if the washing of the hide and the brining operation was not proper this process may be harmful rather than beneficial. Mc Laughlin and co-workers (19-20) then studied different factors from bacteriological and chemical point of view, which may affect the process of brining. DeBeukelaer et. al. have demonstrated (from large scale experiments, the superiority of the brining process.) They concluded that brined hides required no washing before soaking in the tanning process and permitted the following operations to be significantly shortened. Improved quality and higher grade of leather could be obtained from bend, (loc. cit) shoulder and belly. They confirmed the findings of Mc Laughlin et. al. that salt stains were practically absent from brined hides. McLaughlin (21) further pointed out that hides if brined properly could be stored for a comparatively longer period without having any deterioration than that of the hides cured in ordinary way. Dempsey et.al.(loc.cit) found that calf-skins brined in saturated salt solution previous to light salting produced leather of better fibre structure and more distensible grain. Koppenhoefer and Somer showed the superiority of the brining process in curing efficiency on the basis of their volatile nitrogen and free fatty acid data. Grassmann and Hausam opined that if the brine was quite saturated and the hides were well drained, salted down after brining, the process was advantageous. Roddy (loc.cit) and Roddy and Hermose (loc. cit) showed the advantage of brining followed by salting over that of treating with dry salt alone.

It is however true that the process of brining is not so simple as that of salting with solid salt because it favours consideration of some of the following factors which may retard the efficiency of the process.

1. Strength of the brine :

McLaughlin and Theis in their work used a 25% salt solution and brined for a period of 24 hours. Lloyd (22) concluded that brine of a lower concentration than 20% at a temperature of 68-70°F could not prevent putrefaction but at a higher temperature like 80-90°F a concentration above 27% was necessary. According to Melnik (23) in South American slaughter houses a salt brine of strength 22-24°Be¹ is used. Grassmann and Hausam (24-25) denoted that 25% salt on the solution basis may be considered as the lower limit. Luksemburg et.al. (loc. cit) suggested a solution of 23-24°Be¹ and the treatment should be undertaken for at least 18 hours. DeBeukelaer pointed out that the brine should be maintained at the saturation level and the minimum period of brining should be 15 to 16 hours.

2. PH of brine solution

The effect of pH of the salt solution on the brining process is not clear. It appears that brining in slightly acid condition may be better. McLaughlin and Rockwell (loc. cit) found from the experiments that an acid brine was more efficient in preserving hides than neutral brine. De Beukelaer (loc. cit) in his experiment used a buffer mixture of boric acid and borax and controlled the pH at 6.8-7.0. Stuart and Frey from (26) one of their experiment supported this idea of brining in acid medium. They found that the growth of halophilic red heat organisms was inhibited by slightly acid brines. No growth developed on pieces of calfskins treated with brine at pH 5. Strandine and Connick found that acid brines produce shrinks in calfskins, while alkaline brines tend to produce increases in weight and at pH 5 to 7 there occurred maximum extraction of protein from skins. Stather and Herfeld (28) concluded that adjusting the PH of a 32% solution to 5,7,9 and 11 had little, if any, effect on the amount of salt absorbed, the salt distribution or the dehydration. They further found that the amount of total nitrogenous matter soluble in brine was maximum at pH 9-10 and decreased both towards the acid and alkaline side but the hydrophilic action of salt on hide substance was maximum at pH 6 decreasing on either side.

3. Purification of the brine solution

It is of course true that by using the brine solution repeatedly, it gets contaminated with different impurities e.g. blood, manure and other proteinous substances soluble in brine, whereby the pH is raised to the alkaline side and in such a medium the micro-organisms becomes active. The brine should therefore be filtered and sterilised if necessary. One of the easy method is to filter the brine through sand. According to Meinic the brine could be used several times and purified by sedimentation and also by evaporation and filtration when necessary. De Beukelaer et. al. (loc. cit) were of the opinion that the brine should be sterilised at least once or twice a week. They sterilised the brine by pumping it to a large vat and heating it with open live steam until all the proteins, coagulated by heat were thrown out. According to Luksemburg et. al. (loc. cit) the brine should not be used more than five times.

4. Hide brine ratio

Melnik (loc. cit) pointed that in South America the proportion of brine to hide weight varied from 2:1 to 3.8:1, De Beukelaer used 5 brine to 1 part hide. According to Luksemburg et. al. and Koppenhoefer and Somer the brine and hide ratio should be 4:1. Mc. Laughlin et. al. (loc. cit) showed 4 parts of brine to 1 part of hide was better than 2 parts of brine and 1 parts of hide from the point of bacterial growth.

Other factors

Bergmann was of opinion that brining skins in concentrated salt solutions reduced their permeability to water and therefore brining in a too concentrated solution was avoidable. But De Beukelaer et. al. (loc. cit) submitted that no blocking or interference of salt was occurred from concentrated brine. Moreover they found that salt was uptake of hide

increased regularly with the period of brining and the salt content of brine. They further found that the salt penetration was the most rapid in the dry salted hides and required from 5 to 11 hours, for complete penetration where as, it took 6-12 hours in saturated salt solutions but a comparatively longer time is necessary to completely saturate it with salt. But according to Stather and Herfeld (29) the absorption of salt is more rapid during the first hours of brining independent of the concentration of the brine and reached a maximum after about 12 hours. With 32 per cent salt solution they found that at first the salt content of the outer layers were over double those of the inner layers. De Beukelar et. al. (loc. cit) however, later found from their stratigraphic distribution studies that saturated brine penetrated into fleshed hide very rapidly when brined, or when treated with saturated brine on the flesh side. Regarding the nature of dehydration Stather and Herfeld (loc. cit) pointed out that solid salt dehydrated quicker than brine but on the other hand they found with 32% salt solution that the water content dropped away first at the end of 12 hours and then rose again. Loller and O' Flaherty (30)(31) showed that the total ash content of the salted hide was higher than that of the brined hide. The salted hides were quite saturated with salt but the brined hides carried more water and less salt which may offer a set back to the cure. It is also assumed to be true as reported by Gassmann and Hansam (31) that even by brining the growth of red halophilic organisms could not be prevented.

It has already been mentioned how the brine is contaminated with large number of harmful micro-organisms and gets associated with different proteinous substances if used repeatedly. So attempts were made as in the case of salting to increase the preservative efficiency of brine by adding disinfectants. Different chemicals and bactericides were tried by different investigators. According to Whitmore et al. (33) Sodium Silicofluoride if added 1 per cent calculated on the salt content of the brine gave better results and can be stored for 4 months at 36°C quite satisfactorily. Dempsey et. al. (34) obtained best results when skins were brined with Chlorox 1:250. Luxemburg (loc. cit) found that if 0.03 % chlorocresol, chlorophenol and B-naphthol were used, brine would not be putrefied so rapidly and could be re-used in small factories. Dempsey (loc cit.) reported that in a large scale test the action of sod. pentachlorophenate seemed better than that of Sod. silicofluoride in the brine previous to salting.

Now if we summarise the above facts and figures it will be seen that hides if cured by brining previous to salting could be preserved for a comparatively longer period and can produce leathers of high quality and yield. Brining process of curing is not generally carried out in India it is to you, the Indian Tanners and Raw hide dealers, to consider about the process and to find out whether it is really suitable and of commercial value in Indian conditions.

For a close check up of the process the actual merits and demerits of the brining process can be summarised and represented according to the following way.

Merits

1. A standard quality of cured stock can be obtained if hides are properly brined.

2. When heavy hides are brined and then tanned they give more leather yield than if not brined. They also give higher white weight gain. A high quality and heavier grade of leather could be produced from bends, shoulders or bellies.

3. Brined hides produce thicker, firmer and plumper leather having a clean grain.

4. Salt stains are entirely prevented, if not greatly reduced, even on prolonged storage, if the hides are cured by brining.

5. Heavy hides if cured by brining produce hides more free from dirt and manure, offer no troubles in the usual beam house process. No washing is necessary before soaking them back in the process and if washed at all, the soaking and subsequent processes are considerably shortened.

6. The curing by brining is faster, more uniform and affords greater protection when subjected to adverse condition. Brined hides stored for 4 months showed no signs of deterioration eg. hair slip whereas hides cured by conventional method showed signs of hair slip after 6 weeks under identical conditions.

7. In brining process the question of salt crystal size is eliminated.

8. The process of curing by brining offers saving of salt quantity.

9. Brining appears to give leathers with better fibre structure and more distensible grain.

10. Brine solution can be used repeatedly for a number of times with proper conditioning.

Demerits :

(1) If the hides are not well washed before putting into the brine solution, a lot of dirt, blood and other impurities are accumulated in the liquor which stimulates the growth of bacteria and reduce the curing efficiency.

(2) Factors like the ratio of the hide to brine, strength of the brine, pH of the liquor and the length of brining and draining requires proper control.

(3) Brined hides require special beam house treatment.

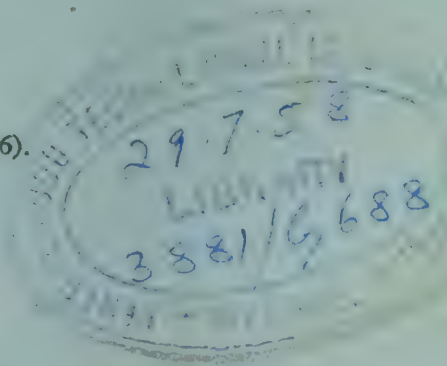
(4) Brined hides or skins carry more water and less salt if not salted again after brining.

(5) Brine solution if used repeatedly without filtering and unsterilised will definitely affect adversely.

(6) The cost in the brining process may be comparatively higher.

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Preservation of Indian Goat skins for export

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Abstract: 120 doz. drysalted skins and 120 doz. Calcutta kills were used in this experiment. Dry-cured skins were given 0.01% or 0.1% sodium pentachlorophenate on their dry weight, and corresponding numbers were kept as controls without antiseptic. Some of the skins were sent to England immediately and some were stored in India through the monsoon. Judging by the number of good glaze kid leathers made from the control skins (i.e., as normal production, with no antiseptic) it was concluded that drysalting, so long as the skins are not to be stored, can give satisfactory cure but improvement in method of cure of Calcutta kills is desirable since they did not give a full percentage of satisfactory leather even when sent immediately to England, while after storage in India during the monsoon the loss was considerably aggravated.

Under English conditions of storage the drysalted skins kept satisfactorily, but the Calcutta kills deteriorated. Under Indian climatic conditions there was appreciable deterioration of all types of skin that had not been treated with antiseptic. The pentachlorophenate improved the resistance of the drysalted skins but not the Calcutta kills owing, it is considered, to the poor condition of the cured skins before they received the antiseptic treatment of the cured skins with 0.1% pentachlorophenate will prevent deterioration if the original bacterial condition of the skins was good.

The hot and humid climatic conditions during the Indian monsoon provide a special storage problem, and as is to be expected, shippers as far as possible avoid, by quick turnover, storing skins during the monsoon. However, both shippers and tanners suffer loss when skins go to pieces during manufacture into leather, and the British Leather Manufacturers' Research Association was asked to make some experiments.

Skins produced in India may be shipped as drysalted, or wet-salted, or dry-salted wet-salted.

Dry-salted skins :

The accepted method of dry-salting is to wash and trim the skins, then nail them flat on boards, rub into the flesh side several coats of Khari salt solution and allow them to dry in the sun.

, Wet-salted skins :

During the winter season, table salt is used for wet-salting, and during the hot, rainy season a mixture of Khari salt and table salt. The skins are trimmed and cleaned on the flesh side, salt is applied, and the skins are allowed to drain, after which more salt is applied.

Dry-salted—wet-salted skins :

The shipper dry-salts some of the skins he receives in the wet-salted state. He scrapes off the cure that has been applied in wet-salting and pegs out the skins in the open. Several coatings of Khari salt solution are given at intervals during a day or so, and the skins are dried out in sun.

Plan of the experiment :

Dried, cured skins were brushed on the flesh side with enough sodium pentachlorophenate (Santobrite) to give approximately 0.01% or 0.1% Santobrite on the dry weight of the skins : corresponding untreated skins were kept as the controls. 120 doz. dry-salted and 120 doz. dry-salted-wet-salted skins were used in all. The skins were dried after brushing and half were sent immediately to England, the other half being kept in India during the monsoon. Half of those sent to England were put into work immediately, and the other half were kept until the second delivery arrived. Two Indian shippers co-operated : one used specially procured skins, cured by normal methods but under supervision : the other used ordinary commercially prepared skins, thus testing the experimental treatment more severely. The skins were made into glaze kid by two English tanners : one used a conventional lime-sulphide unhairing process, and the other an enzyme unhairing process.

Results :

Both tanners reported that the Santobrite had had no effect on the skins during their conversion into leather. The unstored skins of the first delivery may therefore be regarded as showing the range of quality of the various types of skins used in the experiment. The percentage numbers of good skins in the first delivery (unstored skins), as judged from the staked leathers, are shown in Table I. In Table II each result has been expressed as a percentage of the number of satisfactory skins obtainable as judged from the unstored skins in Table I : these figures show the change in the skins on storage in India and in transit. (Figures over 100% are due to random variations from group to group). The effect of Santobrite in preventing deterioration is shown in Table III, where the results for all the stored (English and Indian-stored skins included) dry-salted and all those of Calcutta kill are expressed as a percentage of the possible obtainable.

Conclusions:

Method of Cure (Table I)

Dry-salting, so long as the skins are not to be stored, can give satisfactory cure : 95 % of the supervised skins and 85 % of the normal commercial skins gave good leather (the difference of 10 % is probably not significant).

The cure given to the Calcutta kills used in this experiment was less satisfactory. Of the supervised skins, only 70 % gave good leather, and of the normal commercial skins, only 50 % gave good leather.

Storage in England (Table II)

There was no appreciable deterioration, except in the commercially prepared Calcutta kills which had received no disinfectant: here only half the number of good skins were obtained after storage, as could be expected from the results with the unstored skins.

Storage in India (Table II)

Among the dry-salted skins, there was definite deterioration in the untreated skins.

The Calcutta kills used in the experiment showed marked deterioration, though 0.1% Santobrite was able to protect the specially prepared skins.

Influence of Santobrite (Table III)

The treatment improved the resistance of the skins during storage but was not sufficiently effective for the commercial production of Calcutta kills.

The original condition of the cured skins

The proportion of dry-salted skins that deteriorated during storage was the same in both the shipper-cured skins and the normal commercial skins. This indicates that the differences in the conditions of storage in the two shippers' godowns were not responsible for the difference between the two sets of stored Calcutta kills. The marked deterioration of the commercially prepared Calcutta kills used in the experiments therefore, is attributable to the condition of the cured skins before they were treated with Santobrite.

General conclusions

Improvement in method of cure is desirable. With the Calcutta kills, even the skins specially procured and prepared by shippers and sent immediately to England did not give a full percentage of satisfactory leather, and on storage in India during the monsoon this loss was considerably aggravated in undisinfected skins.

The treatment with 0.1% pentachlorophenate after the skins have been dried will prevent deterioration during storage and shipment if the original bacterial condition of the skins was good.

Table I

**Percentage of unstored skins giving good leather
(Expressed to the nearest 5 units)**

Dry-salted skins		Dry-salted—wet-salted skins	
Mozuffapurs (shipper-cured)	95	Calcutta kills (shipper-cured)	70
Moldhas (commercial cure)	85	Calcutta kills (commercial cure)	50

Table II

Percentage of stored skins giving good leather expressed to nearest 5 units as a percentage of the respective values given in Table I

Stored in England

Stored in India

Mozuffapurs

No treatment	...	80
0.01 % Santobrite	...	100
0.1 % Santobrite	...	95

Mozuffapurs

No treatment	...	70
0.01 % Santobrite	...	90
0.1 % Santobrite	...	80

Moldhas

No treatment	...	100
0.01 % Santobrite	...	105
0.1 % Santobrite	...	95

Moldhas

No treatment	...	60
0.01 % Santobrite	...	95
0.1 % Santobrite	...	85

Calcutta kills (shipper cured)

No treatment	...	90
0.01 % Santobrite	...	90
0.1 % Santobrite	...	115

Calcutta kills (shipper-cured)

No treatment	...	50
0.01 % Santobrite	...	60
0.1 % Santobrite	...	95

Calcutta kills (commercial cure)

No treatment	...	55
0.01 % Santobrite	...	90
0.1 % Santobrite	...	95

Calcutta kills (commercial cure)

No treatment	...	5
0.01 % Santobrite	...	5
0.1 % Santobrite	...	10

Table III

Percentage of stored skins giving good leather expressed to nearest 5 units as a percentage of the respective values given in Table I

	Shipper cured	Commercial cure
Dry-salted skins		
No treatment	...	75
0.01 % Santobrite	...	95
0.1 % Santobrite	...	90
Calcutta kills		
No treatment	...	70
0.01 % Santobrite	...	75
0.1 % Santobrite	...	100

Raw hides & skins—curing & preservation

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The first consideration in connexion with this topic must be the nature and quality of the raw hides and skins concerned. There are certain generalities which do not depend on the efficiency of the curing or preservation but on the animals themselves, their size and that of the hides or skins derived from them. Their nature depends to a large extent on the conditions under which the animal lives, its environment, food and general health.

One expects differences between hides of Indian cattle and buffaloes, and the skins of goats, sheep and reptiles. There are bound to be differences between the different breeds and species of the same animal. These are very important in regard to the properties and appearance of the grain, the thickness of the fibres, their resistance to depilants and bating materials, variations are also noticeable in the characteristics of the various leathers produced. Even amongst skins derived from the same species of animal e.g. goatskins, sheepskins, considerable differences exist among the different types of skins of each species. Hides and skins belong to one of the most individualistic products of nature. The breed and origin of the animal, its mode of life, its food its general condition, age and sex, the time of the year when it dies or is slaughtered all have a bearing on its nature. These various influences exercise a profound influence on its properties which in turn exercise an influence on the subsequent processes of leather manufacture.

In a country as large as India, there must of necessity be numerous breeds of cattle and buffaloes each breed presenting special characteristics peculiar to that breed or type and to the region. Some types are characterised by even growth and development, whereas others are distinguished by uneven growth and substance and are particularly thin in the offal portions. Not only such properties sometimes belong to the breed, but they often persist in the sex of the animal. Bull hides invariably run somewhat lighter in substance in the back regions of the hide and stouter in the belly portions.

Cattle and buffalo hides also vary according to the time of the year at which they die. Not many animals of these types are slaughtered owing to the stern inhibitions against the slaughter of animals, as a result, a large number of cattle hides are procured from dead animals, i.e. animals which have died naturally and have not been slaughtered. The natural causes of death comprise old age, starvation, disease or accidents. The properties of such hides depend on the condition of the animal immediately before death. The hides of diseased animals must obviously be inferior to those of animals slaughtered in good health. The quality of the hides must be seriously impaired by disease, starvation or old ages in the living animal. Death from scarcity or lack of food does not take place suddenly: the animal must have been suffering from lack of food for some time before it finally succumbs to starvation. Surely this approaching condition is capable of observation and suitable treatment could be provided many valuable hides might thereby be saved.

Animals are subject to certain infections such as the parasitic tick various types of mange, warbs, etc. Some of these could have been avoided or quickly eradicated by suitable treatment if the owner had reliable help to make him aware of the trouble. Parasites such as tick could be destroyed by suitable dressing of the animal. Not only could "tick" infection be thus removed but the treated animal would be rid of a troublesome and irritating complaint. The female tick attaches itself to the hide of the animal by its mouth parts and sucks blood from the animal. This causes irritation, annoyance and actual hide damage to the grain and tissue immediately under that part of the hide. Tick marks frequently show on the flesh side, particularly, in the case of sheepskins. Not only is the grain damaged by tick but the hard places persist through the whole thickness of some skins; tick marks showing through the flesh side under the skins unfit for a flesh finish such as "velvet". Sheep skins may be badly damaged by "tick". Here is another example of a complaint which could have been eradicated or minimised by suitable dressings.

Finally, what about the actual curing and preservation of the raw hides and skins. They are highly putrescible; subject to mould and bacterial attack. In a recent article which appeared in leather and shoes, an address by President Eberle to the Tanners Council of U.S.A. is reported in which he is reported to have said; "Quality pays, if you want it, you must pay for it. The future of our business (leather) depends on the character of the raw material reaching our beamhouses. Every effort we make singly or jointly to build profitable markets for leather and hides rests on the base of the quality of our raw material".

It is evident from this that every endeavour should be made to avoid any possible deterioration in the raw hides and skins, once they have been removed from the animal's body. The flesh side could be sprayed with solutions of sodium trichlorophenate, pentachlorophenate or similar bactericides. Animal pelt is a highly putrescible material which will sustain micro-organisms of all types so that the correct use of suitable preserving agents is of the utmost importance to the preservation of hides and skins for the making of leather. Damage by putrefactive organisms can be prevented as well as salt stains and mould attack.

Factors Affecting the Salting of Raw hides and Skins and their Preservation.

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Salting is one of the most common and efficient methods of preserving raw hides and skins as well as fish and meat, if properly carried out. Wet salting of hides can be carried out in two ways (a) by applying solid powdered salt and (b) by brining, of which the former is generally practised in this country. Salting by powdered salt can again be divided into two processes. (1) wet salting and (2) dry salting, both of which are common in India. It is well known to the tanners as well as the hide merchants that, common salt can preserve the hides and skins only for a limited period in sound condition. The reason for this is evident for

the fact that, common salt usually contains salt resistant bacteria which slowly adapt themselves under the conditions of salting and subsequently produce many defects directly or indirectly. One of such defects is the production of 'red-heat'. Other than these principal features, the curing efficiency of common salt is largely influenced by a number of factors. Here we are going to discuss some prime factors which are responsible to a great extent, in controlling the curing efficiency.

Nature of the salt :

Common salt may be of three kinds (1) sea salt, (2) rock salt (3) lake salt. All these three types can be used for curing. Sea salt has got disadvantage that, it being produced from sea brine by solar evaporation, contains a large number of halophilic organisms i.e., salt loving organisms which are the cause of the trouble known as 'red-heat' as we have mentioned earlier. Solar salt also contains Ca and Mg sulphates and chlorides as impurities. Rock salt on the other hand does not produce 'red-heat'. So wherever available the use of rock salt may be advantageous provided it is free from other chemical impurities. The use of clean salt being freed from different impurities is always advantageous in any case.

Quality of the salt :

Calcium and magnesium salts are undesirable constituents of good curing salt. They make the salt hygroscopic and can act on collagen more than that of sodium chloride. These salts precipitates Sod. carbonate, if added in admixture with common salt and may cause damage due to precipitation of insoluble carbonates. They may also in contact with free fatty acids from rancid fats, form insoluble metallic soaps which may produce grease spots. The presence of traces of iron (1) in common salt often produces salt stain on the lined pelt. Lokshin & Luksemburg (2) pointed that salt should contain not more than 0.01 per cent iron and less than 1.0 per cent of calcium sulphate. It was concluded by a number of investigators (3) (4), (5), (6) that curing salt should never contain more than 1.0 per cent of magnesium and calcium salts for better curing. Bravo (7) suggested the following composition of salt to obtain ideal results in curing—M & Cl_2 —upto 1.6 per cent, CaSO_4 —upto 0.75 per cent, Na_2SO_4 —upto 1.2 per cent and insoluble—upto 0.05 per cent. Indian Standards Institution (8) has also prescribed the specifications for the curing salts available in India.

Quantity of the salt :

This point is very important as you know, inadequate salting always stimulate the growth of harmful bacteria and thereby helps putrefaction. Stather & Herfeld (9) found that if cured with too little salt, the finished leathers produced are loose, porous and of lower yield. On the other hand, according to Hausam (10) too much salt acts unfavourably on the grain of calf-skins. Too much salt may also help in the growth of halophilic organisms. So it is better to apply proper amount of salt for efficient preservation. Laufmann (11) suggested the salting with salt amounting to 30-40 per cent on the weight of the hides. Lokshin & Luksemburg (2) concluded that 40-50 per cent of salt on the weight of the skins must be used. The B.L.M.R.A. (12)

preferred 30-35 per cent of salt on the butchers weight for hides if these are preserved for a comparatively longer period. Australian investigators (13) recommended 33 per cent of salt on the butcher's weight for ox hides. For calf skins, however, Grassmann & Hausam (14) recommended 40 to 50 per cent of salt according to condition as they contain more moisture. Stuart and Frey (15) showed that hides should be saturated with sodium chloride to have a better cure and preservation and they found that 33 per cent of salt is sufficient for saturation. In an experiment with Indian cow hides in this laboratory (16) we found that 35 per cent of salt on the raw weight gives better cure and preservation.

Grain size of the salt :

The effect of grain size of the salt on the curing process is well recognised. It has been found that neither too large nor too fine grained salt gives a desirable cure as the medium sized salt. Coarse salt is unsuitable due to the fact that it cannot cover the hide surface completely and hence the production of brine becomes slower. Moreover it can cause damage from salt impressions and by producing salt stains. Fine salt, on the other hand chokes the flesh side and cakes on the hide surface whereby its activity is diminished. Secondly, although brine is produced very rapidly with fine salt it may result in a 'Case-brining' effect and thus permeation of the hide becomes insufficient. Bergmann and Seligsberger (17) showed that a more rapid absorption of salt occurred with salt of grain size 1-2 mm. The International council of Tanners (18) has recommended a salt with 2-3 mm. or 1/8 inch grain. Koppenhoefer & Somer (19) have also demonstrated from their volatile nitrogen and free fatty acid data that, salt of 2-3 mm. size produces better cure. For calfskin, however, a mixture of different grains was suggested by Hausam (20). Other than these granular salts another type of salt was also tried by the B.L.M.R.A. (21) for its possible use in curing hides and skins. This is called dendric salt and the crystals are branched. According to them, the high specific surface of the salt gives it the properties of low bulk density, rapid solubility in water and high capacity for absorbing moisture without becoming palpably wet.

Curing by used salt :

The reuse of curing salt for preserving hides and skins is a common practice in India like some other countries. But it is a bad practice, as McLaughlin, Blank and Rockwell (22) showed that used salt contains a large number of organisms in proportion to that of unused salt and most of these organisms are of proteolytic type i.e., they can hydrolize hide proteins. They were also of opinion that the used salt crystals are usually coated with a layer of the impurities e.g., blood, manure etc., which retard the salt absorption by the hide and hence dohydration. Bergmann & Hausam (23) also expressed the same opinion as old salt contains bacteria and eggs and larvae of flies which can develop into insects on used salt. Anderson (24) showed that the salt tolerance of the non-halophilic organism, such as *B. subtilis* could be appreciably increased by repeated subculturing. On the other hand Kritzing and Van Zyl (25) showed that salt containing upto 4 per cent insoluble matter does not affect the rate of salt absorption or dehydration of the hide.

But he agreed that reuse of salt containing considerable number of micro-organisms always runs the risk of damaging hides in storage during preservation. Recently from an experiment in this laboratory (26) we have found that the staling period i.e., the time elapsing between the flaying and curing influences greatly the bacterial content of used salt. Salt collected from hides staled for increasing periods upto putrefaction contain increasing numbers of bacteria and nitrogenous matter. The grain size of the salt may also be appreciably affected if once used previously. Kritzinger & Van Zyl suggested the use of 2.0 per cent sodium silico fluoride in admixture with common salt which is a direct bactericide but in our opinion, this will not be of commercial importance in India than that of fresh salt alone.

Effect of Temperature :

The high temperature prevailing in India, specially in summer time, is evidently the reason for innumerable loss to the hide and skin trade. Bacterial growth and activity is appreciably catalysed with the rise in temperature from 0° to about 40°C but with further rise in temperature, it is depreciated. So in India, having a higher temperature, the hides and skins, either before curing or after curing are much more easily attacked and destroyed by the micro-organisms and that is why a hide properly cured can be preserved in England for one year quite safely, whereas, in India a properly cured hide can hardly be preserved for more than six or seven weeks from putrefactive damages. Refrigerated hide cellars are largely provided now-a-days in many countries for storing and preserving hides and skins. Although cold storage does not stop deterioration it delays it to a great extent. Cold can, however, injure hides by freezing, the ice crystals can rupture the tissue. A thawed hide is of soft texture without resistance and yields leather which is without firmness or durability. The effect of temperature on the growth of bacteria from fresh skin were noted by McLaughlin and co-workers (27), (28). They showed that for most bacteria the optimum temperature lies between 15°C to 37°C. Koppenhoefer & Somer showed from the production of volatile and free fatty acid that curing above 20°C is comparatively dangerous. Stockell (29) recommended that the temperature of the ware-house should lie between 30 and 35°F. Stuart & Frey (30) have showed experimentally that in cold storage hides and skins can be kept satisfactorily upto five years. The authors (31) have found that preserving hides and skins at a temperature of 10°-18°C is of great practical importance.

Moisture content of salted hide:

To keep the basic qualities of the hides in sound condition, factors like the moisture content of the hide is to be considered. It has been shown that moisture plays a very important role in governing the microbial activity in the wet salted hides during storage. Although the moisture of the raw hide vary considerably, it lies between 60-70 per cent. After proper salting this is generally depressed to about 40-45 % (32), (33). Stuart and Frey pointed out that hides containing upto 50% moisture content can be stored safely. But Nandy, Sen and Das (34) concluded that for better preservation during storage hides should not contain more than 45 per cent of moisture. It is true, that the moisture content of the hides cannot be controlled so easily

without controlling the humidity of the hide celler. Because even a little difference in the atmospheric Relative Humidity will affect on the water content of the salted hides, specially in the case of dry salted hides. The variation in the moisture content of the skin becomes less if the exposure of the skin surface to the air is less. It was found that (35) in skins, if stored with hair outwards, the moisture content varied more rapidly than with flesh outward. This is said to be due to the capillaries being larger on the hair side than on the flesh side. The moisture content of the hides may also be altered due to the impurities in the curing salt, which are hygroscopic in nature.

Effect of Humidity:

As in the case of temperature and moisture content of the hide or skin, atmospheric humidity is another important factor which can influence the quality of the cured stock. This is why, hides and skins dry salted with common salt suffers the set back. The growth of the red halophilic organisms (37) as we have pointed earlier are also influenced with the atmospheric humidity. Innes (37) pointed out that dry salted skins can absorb moisture when the Relative humidity exceeds 75 per cent. At 94-96% Relative humidity, the water content of dry salted calf-skin may vary from 22.2-51.3 per cent. To find out the effect of humidity on wet salted hides during preservation we (38) carried out experiments with cow hide and found that the range of 70-80 per cent Relative Humidity gave better preservation of wet salted stock although the efficiency was increased at lower temperature (20°C) than at higher temperature (30°C) having the same range of humidity.

Additions to curing salt:

Common salt having a poor bacteriostatic action cannot achieve the desirable efficiency on curing. So it is a long felt need to find out some additives to common salt which will prevent the bacterial growth without affecting the qualities of the stock in any way. Investigations are already carried out in different parts of the world for the last half century or above in this direction. But it is, however, a difficult problem because a large number of factors are to be considered before choosing a material. The material should be cheap and readily available, having desirable bactericidal and fungicidal effect, non toxic having no deteriorating action on hides and skins, suitable for the manufacture of glue and gelatine etc. It is rather useless to give you in details the references of the innumerable materials tried out for this purpose but a few of the partially successful agents and some recent developments may be discussed.

Paessler (39), (40) suggested in the year 1912, the addition of sodium carbonate to control the yellow brown salt stains. This suggestion was widely accepted in actual practice and specially in Germany. Bergmann (41), Seligsberger (42), Schuck & Hausam (43) demonstrated from practical salting tests that the practice of using soda ash in the proportion of 3% on the weight of the salt is really helpful. Finally it was suggested and approved by a number of investigators to use 2-4% of soda ash and 1% naphthalene in conjunction with it. The only sound objection raised against this was due to Lloyd, Marriot and Robertson (44) who pointed out that the final leather produced after

such curing is soft and spongy. But even very recently Dr. Freudenberg (45) expressed the idea that in Western Germany he achieved good results by adding 2-4 % soda ash and 1 per cent naphthalene to all skins and light hides. Other than soda ash the addition of sodium fluoride or silicofluoride may be mentioned which was first suggested by Romana & Baldracco (47) and later by a number of workers in this field. The works of Knitzinger (47) (48) may be specially mentioned who tried to exploit sodium silicofluoride in different spheres of curing and preservation. But there are lots of objections also from different corners against its use. Even, South Africa, the main users, has now stopped the use of silicofluoride and expects to develop better disinfectants.

Sodium trichlorophenate and Pentachlorophenate were tried by different workers (49) (32) but with mixed success. Raschit (p-chlor m-cresol) in the proportion of 0.2 % on hide is reported (50) to produce better result preventing bacterial spots and producing good quality eather. Promising results have been obtained by adding Merpin W.S. Extra (51), (52), (53) with salt in the proportion of 2%_s. Bacterial spots and discolourations are reported to be mostly absent even in difficult storage conditions. A recent patent (54) indicates the suitability of a new material in admixture with common salt and this is sodium chlorite. Sodium chlorite if added in the proportion of 1 % to common salt is claimed to inhibit halophilic bacteria for long period. Here we may point out another process of sterilising hides or skins which would probably come up in near future. Large sources of ionising radiation which are by-products of the large scale use of atomic energy may be available in future for leather industry. Dempsey, Haines & Raymond (19) have shown that the radiation had no deleterious effect on the fibre structure and could be used in preserving raw hides and skins.

In conclusion we can simply say that even to-day there is no disinfectant which is cent per cent safe and effective, and it is therefore very imperative further work be continued in this line.

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Some aspects of curing practice.

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The purpose of curing is to preserve the raw hides and skins in good condition until they are to be processed later into leather.

As soon as the animal is slaughtered or is dead and life processes cease, the proteolytic bacteria begin to attack the skin. To the tanners the value of the skin is in direct relation.

- (i) To the extent of its digestion by bacteria ; and
- (ii) other degenerative changes.

Bacteria require water for their metabolism, and methods of curing aim at reducing the available free water in the raw hides and skins. This partial dehydration is achieved by treatment with salt or air drying or combination of both. Hence the common procedures followed are :—

1. Wet salting.
2. Dry salting.
3. Mere Sun drying.

However in actual practice certain practices are prevalent in the trade.

1. Hides and skins are not washed well before salting.
2. The lag between flaying and curing operation is generally 6-8 hrs.

It is worth while at this juncture to recapitulate the following facts :—

1. The growth of the proteolytic bacteria is encouraged by available protein substances, as blood etc.
2. Skin corium—the leather making substance is very sensitive to the action of proteolytic bacteria.
3. Bacterial growth is restricted by 18% sodium chloride concentration and in presence of blood serum 22% salt is required.
4. If flesh side is covered with blood it delays salt diffusion.

<i>Time of salting.</i>		<i>Percentage chloride with blood.</i>	<i>Sodium absorbed blood removed.</i>
Delaying 1 Hr.	...	1.05	1.82
„ 4½ Hrs.	...	2.21	2.79
„ 24 Hrs.	...	6.36	6.51

It is also observed that much greater salt absorption occurs during the early and most important hours of curing in the absence of blood.

5. Time lag between flaying and curing reduces salt absorption.

<i>Time lag.</i>		<i>Percent salt absorbed.</i>
None	...	1.65
1 Hr.	...	1.14
2 Hrs.	...	1.04
4½ Hrs.	...	0.39

6. In the early hours of curing bulk of the salt is taken up from the flesh side. Hence the removal of adhering flesh and fat facilitates salt absorption.

7. If fresh hide is to lie in air for varying time periods without curing treatment, the capacity of corium to swell in lime solution is decreased.

<i>Hours of post mortem.</i>		<i>Swelling when corium was exposed to atmosphere during post mortem.</i>
0.5	...	100
1.5	...	86
3.5	...	77

This aspect has to be specially considered with regard to curing of fallen hides. Viewed from this aspect the scheme detailed later, to be put up by U.P. Government commends itself.

As such it is essential that slaughtered goods, after the escape of body heat which takes 2 hours from flaying, should be well washed and cured at or near the slaughter house itself. This eliminates the time lag between flaying and curing. This may not prove to be a difficult affair, as tanners mostly purchase the hides and skins direct from the slaughter houses through their respective agents, who can have the first salting done at or near the slaughter house. This practice will go a long way in improving the standard and quality of the cured product.

In the case of skins the percentage of 'slaughtered' is high and as the percentage of urban 'Slaughtered,' is substantial, and as water and other facilities for curing are easy of access in urban areas, positive results could be arrived at without much difficulty in organising this set up.

In the case of hides, the position is different. Even normally the percentage of 'Slaughtered' is low, i.e. nearly 13 per cent of total hide production. In addition now there is a campaign for banning cow slaughter. As such the possibility of getting green hides are likely to be remote and as fallen hides are to be the raw material for the tanning industry, in addition to the characteristics of a fallen pelt, additional

factors as delayed curing etc. will also come into play, resulting in leather of poor yield and standard.

To counteract this, the Uttar Pradesh Government have evolved a scheme with the guidance of the F.A.O. Expert Mr. Hoek. As per the scheme, Gosadans are to be established in different places wherein aged cattle will be confined and fed. As soon as they die, the hides will be flayed and cured at the Gosadans. The product is thus as good as green hides. Further there is the additional advantage in the useful utilisation of bye-products, otherwise going to waste, in the preparation of bone meal, glue, etc.

Similar schemes can be started as pilot work in different states, these schemes can be formulated as adjuncts to the different flaying-cum-curing demonstration centres that are to be set up with the aid of All India Khadi and Village Industries Board. The standard of hides prepared and cured in this way is bound to be good.

In India, the practice of curing by 'Brining method' is not in vogue. In the curing method by wet salting, the curing salt has to be dissolved in water before it can penetrate the hide. Hence in salting method, the curing process will not begin until the salt crystals have extracted water from hide and thus formed brine. In the brining method saturated brine solution is already available there at the start itself. Hence in the brining process all the bacteria present in hide are immediately subjected to the antiseptic action of the performed salt solution. Thus in this method, there is a greater salt absorption in the initial and most important hours of curing. In this method greater amount of coagulable proteins are removed. Compared to salting, brined hides respond to soaking and liming more rapidly. They also do not get 'heated' so readily as unbrined hides.

Brined hides yield a plumper and fuller leather with no salt stains. It allows for uniformity in the tanning process and in finished leather.

Brined hides give a greater yield on tanning. They require a sharper and shorter treatment in the Beam house.

If yield of leather by ordinary salt treatment is taken as 1.0 brined stock with mellow Beam house treatment gives 1.1 and brined stock with sharper beam house treatment is found to give 1.7.

The quality of Indian hides which are normally of poor substance, should definitely increase and respond better if they are to be cured by the brining method. This method of curing can be tried at different flaying-cum-curing centres and the hides so treated should be sold to some of the enlightened tanners for processing in their tanneries. Should the results be successful, the tanners will no doubt insist on having such type of cured hides, and it will be easier for this method to be popularised. This may also enable to overcome the problems now faces in the production of chrome upper leather from hides of dead animals.

Steps should also be taken to eliminate the curing method of 'mere air drying'. It is a common feature that a high percentage of hides so cured, generally putrefy and go off in the lime yard, leading the tanner

to losses. It will be helpful if they could be treated by the brining method and then let dry in the shade.

Apart from the usual curing with common salt, other salts and blends have been suggested. Sodium chloride is found to be better than sodium sulphate. Acid reacting brine is found to be efficient for the preservation of hides, salt solutions at pH 5.0 with the addition of proper fungicides to prevent mould action is often recommended. The general defect of salt stain-attributed to stains of bacterial growth is avoided by adding 3.5 % anhydrous soda ash to the curing agent.

Trails on pilot scale using these and other improved recipes can be experimented at the flaying-cum-curing centres under the guidance of technical officers from Central Leather Research Institute, Small Industries Service Institute etc.

A study of curing practice with a view to improve the same usually leads one to think in terms of improving the operation which precedes it, i.e., flaying, the removal of hide or skin from the carcass. The flayer should impart as much importance to the quality of hide flayed as he does in trying to keep the white adipose tissue on to the carcass. Carelessness in this operation leading to flay cuts and holes in hides reduce the value and strength of hides considerably. By pulling the hide away from the carcass while flaying and using a knife with rounded head and by performing the operation with care, these defects could be overcome.

The All India Khadi and Village Industries Board have schemes to send out demonstration parties for demonstrating and imparting training to the village butchers on improved methods of flaying.

Incentives should be given to flayers who flay hides without flay cuts. The scheme of the marketing Directorate of the Food and Agricultural Ministry introduced in 1937 and subsequently left off, by which flayers used to get extra payment for flaying without cuts, should be revived. Tanners will never desist to pay more money to the raw hide free from flay cuts. As such, some scheme of quality marking which ensures of better standard of flaying and hence a better quality of hide, and involving some extra payment by the tanners is bound to prove helpful.

In view of the fact that the areas of production of raw hides and skins are widely scattered through out the country, there is the difficulty in co-ordinating and implementing any scheme for improvement. However, at present we can with advantage make use of the community project organisation in the implementation of the schemes for developing this industry. The entire country is to be covered by Community Project and National Extension Service Blocks by the end of the Second Plan. Each of these Blocks has an Industrial Extension Officer to look after the needs and development of Industry in his area. These officers and the Gram—Sewaks working under them could be associated with in the development programmes and pilot work of this industry.

In view of the complex nature and organisation of the industry, it will take time for results to be achieved in a full measure. However, there is one great advantage at present. Their tanners are value

to the problems of improved curing. With their help and that of organisations as Central Leather Research Institute, Small Industries Service Institute, The All India Khadi and Village Industries Board, etc. it will be easy to put through and follow up different development programmes for this industry. As such if a beginning is made in the right direction, ere-long concrete results can be achieved to the betterment of the industry and the national economy.

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Curing of Hides and Skins.

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India is a large producer of hides and skins and also a place where such valuable raw material is wasted for want of proper knowledge of flaying and curing. We are among very few countries possessing very large cattle population. Still we are the worst sufferers in case of hides and skins. Especially with the new laws regarding the slaughter of animals, that are prevailing in some States, the quality of the hides have gone down tremendously. It is only an aged and useless animal that is allowed to be killed. Secondly our agriculturists and farmers do not pay sufficient attention to their cattle. In quite a number of cases the animals lack such fundamental facilities as stables. Most of the animals in villages keep on roaming about without proper shelter. Naturally they are victims of various diseases. The worst part of it is that they are allowed to breed in these appalling conditions, thus affecting the future generations. No proper care about feeding of breeding is exercised. The worst places might be the so called 'Goshalas'. They are nothing but places for collecting all sorts of suffering animals. In majority of cases a butcher's knife would be the kindest method to end the sufferings. India still has a fairly large population of beef eaters and also they are very bright possibilities of developing a trade in frozen meat. It is felt that if free slaughter is allowed along with export of meat, this will lead to betterment of our cattle more effectively than anything else. Higher prices for better animals will induce farmers to take more care of their animals. They will feed them properly and also care for them. This question will have to be tackled without getting sentimental. It is a plain and simple economic question. In Europe it is actually proved that an agriculturist gets his ploughing etc. done without spending a pie. He buys a young animal, feeds and trains properly for field work. When the efficiency of this animal goes down, it is again fattened for butcher and sold. In majority of cases the value thus realised is much more than the total investment on such an animal.

With this state of affairs it is no wonder that our Tanners are finding it a very difficult task to get suitable raw material for various types of jobs. Our overall selection has dropped down considerably. It is practically impossible to get appreciable quantities of I or II. In a number of cases, a little more care in handling a hide, after taking off the animal, would have given a higher selection. Ignorance and carelessness on the part of people collecting the hides are solely responsible for such damages.

Ours is a vast country with varying temperatures and weather conditions. We therefore cannot have absolutely uniform method all over the country. Secondly season of the year also counts. Third and very important factor is that this collection of raw hides is primarily done in small villages where control on methods is very difficult. In organised slaughter house, it may be possible to adapt a standard method and control. The working, while, in villages it is the interest of the collector of hides that will have to be touched. This can happen only if tanners and other buyers co-operate and put in force a plan of grading and paying according to grades. Government agency can play a very big part in this. If all the raw hide markets are "quality controlled" by authorities, the sellers would be forced to improve the quality of the material. It may be mentioned there that years ago when expert of raw hides was allowed, the collectors of hides took much more interest. They knew that they would not receive a price if the hides are sub-standard. Due to present shortage, tanner has no other go but to buy whatever is offered or run the risk of suffering for want of raw material.

Affairs in skins trade are not so bad, because most of the skins collected are from animals killed for food. There is also a big market for export of raw skins and these merchants—exporters—have their own purchasing agency who take care of all the skins purchased. Still we lack in proper method of handling. Buyers at the other end are not yet sure of the results that could be expected and thus hesitate to offer better rates. Only a few well known shippers treat the skins properly for which they get better rates also. But most of the shippers do not bother much. There have been instances when skins with 'Hair Slip' have been dried out and shipped. With an idea to find out an efficient and economical method, the following work was undertaken :

Preservation of hides and skins : This has been engaging attention of various workers in the leather trade. Observations on various types of cures generally practised have been made both by Indian and European workers and in light of their work and the practical experience gained during the last few years, some of the following methods were tried and were found satisfactory.

Methods of preservation for hides and skins differ a little because of the nature of the raw materials and also differ seasonally as well as statewise.

Most commonly practised method is salting hides and skins and then sending them to places of collection. Here they are sometimes resalted and also dried or sent to market places without drying. Some places use Khar salt in place of sea salt. Goods meant for export are also dusted with naphthaline before they are baled.

The following method for dry salting goat skins was found very satisfactory. Skins as soon as they are received from slaughter house were washed in cold water and then left over in 1% Borax solution overnight. In Bombay we generally received the skins at about 9 p.m. That is about 5 to 6 hours after the animal is killed. Conditions in the local slaughter house are far from satisfactory. The skins lie about in pools of blood and dirt and are also warm.

Next morning these skins were drained and then fleshed to remove excess of flesh, fat etc. and then were divided into two groups—Group A was brined and Group B was salted with powdered sea salt to which small quantities 1:200 of Preventol Liquid (Chika Ltd.) was added by sprinkling. Group A : Saturated solution of common salt was prepared in large wooden tub by adding sufficient quantity of salt and excess. This was prepared about 24 hours before the skins were put in. Skins were handled in this brine and left for about 12 hours. Skins were then nailed out and dried in shade. After more or less complete drying, the skins were dried in the sun for a short while, dusted well to remove excess of salt and brushed on the hair side. A small quantity of Naphthaline powder was sprinkled on the hair side before folding for baling.

Group B : After draining well as above, the skins were salted with full quantity of powdered and treated salt and piled. Small piles consisting about 120 to 150 skins were made. Skins were left out in these piles for 12 hours during which time quite an amount of water drained out from them. Next day, they were again salted lightly with the same salt and spread out to dry in shade. When the skins were more or less dry, the drying was completed in sun. Skins were baled without any naphthaline.

Part of both these skins were kept in normal godowns as they exist in any raw hide market for about 4 to 5 months and part of them were kept in baled condition in the same godowns for the same duration. Skins after this period were treated in a tannery producing vegetable tanned leathers and the following observations were made. A control lot of skins generally exported in dry salted condition was also processed side by side.

Control Lot.: After soaking in normal way about 2% skins were found under-soaked in places. Hair loosened on quite a number of skins and after a short drumming in running water quite a lot of them lost hair in places. The drum wash water showed a lot of hide substance. Even the soak water showed this. Skins were limed as usual in slightly sharpened limes. No skins got damaged due to bacterial action totally. A few skins were found slightly damaged only on flesh side probably in spots where some excess flesh was left and the skin did not get dried properly. Portions of some skins were found underlined even though the lot as such was found well limed. Portions of grain looked like drawn grain in these places, showing defective salting and drying. Irons stains were found in quite a number of skins especially along the direction of hair growth. This might be due to blood or impurities in salt. Grain was rather weak and did not stand scudding well. Hazy patches were observed after vegetable tanning and veins were also found prominently.

Group A : Lot soaked much better and quicker than control lot. All the skins were soaked more or less evenly and hair slip was negligible. Soak liquor did not show any evidence of hide substance in solution but soak drum liquor showed a small amount. After liming, the skins were found generally brighter than the control lot and the incidence of iron stains was very much reduced. Still there were some skins with quite and appreciable amount of iron stains. No skin even in slight patches were affected by bacterial action during liming. After vegetable tanning, the skins appeared fuller and cleaner and gave a higher yield also. Vains were observed on a few skins but the proportion was much lower than the control lot.

Group B : Lot soaked well nearly as good as Group A. A few skins remained under-soaked and had to be worked extra. Soak liquor did not contain any hide substance. Even the liquor from soaking drum was fairly free from hide substance. Less than Group A. Skins limed well had a bright appearance stood scudding well and were practically free from iron stains. After tanning, the lot was found to compare well with Group A and the vainliness was also reduced appreciably. On the whole, this was found to give quite satisfactory results.

Economic aspects : Both the methods, A and B, were a bit costlier than usual method practised but the gains were much more than the amount spent extra. Of A and B, A was found costlier especially as the quantity of salt required was much more than usual safeting. In places away from coast, this will make a big difference in the cost of curing. Method B thus was found not suitable for the conditions prevailing at present in our trade.

Difficulties : In practice especially when very small number of skins are collected it is very difficult to get them washed properly. There are a number of places where getting good water is also a problem. But atleast in places where an appreciable number is available daily, some arrangements for initial washing after slaughter could be arranged. Getting chemicals and salt is also difficult in many places. Some depots that will supply these will have to be opened. It has been an experience that very poor quality of salt has ruined quite an appreciable number of hides and skins. Various organisations set up by Government and Semi-Government bodies can undertake this and thus help the improvement.

Some considerations on the utilization of Bittern Salt in curing.

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With the industrial progress of India in various directions it is indeed the proper time to consider seriously to utilise raw materials which are even now treated as industrial waste. The Bitterns, which are discharged from Sambhar lake during the preparation of Sodium Chloride, have been wasted for past many years and only recently, attentions have been directed for proper utilization of these waste materials. Recently, some move has been taken by higher authorities to consider proper ways and means for the exploitation of those Bitterns.

In this connection we want to suggest some considerations regarding its utilization in Leather Industry.

These Bitterns are rejected at brine concentration of 20°Be, most probably due to the fact that further quantities of salt of desirable quality could not be recovered from these bitterns which are highly dense. It is estimated that the wasted bitterns amount to several lac tons. It is also roughly estimated that about 60,00,000 cu.ft. of bitterns are discharged every year. According to Mataprasad and Mehta (1), the approximate composition of the bitterns on solid basis will be :

NaCl	...	68%
Na ₂ SO ₄	...	17%
Na ₂ CO ₃ (or NaHCO ₃)	...	15%

Thus every year about 38,620 tons of NaCl, 9,653 tons of Na₂SO₄ and 8,519 tons of Na₂CO₃ and NaHCO₃ are really wasted. The composition of the bitterns vary when these are in solid state that when in the liquid state. It may also change in different areas from which these are obtained. On the basis of Humes estimate and analysis of the black mud of the lake bed, the composition on solid basis of the lake brine, subsoil brine and the bitterns at Sambhar are given below :

		Lake Brine.	Subsoil Brine	Bitterns.
NaCl	...	87.9	78.9	66.0
Na ₂ SO ₄	...	7.2	14.3	21.3
Na ₂ CO ₃ (including NaHCO ₃).	...	4.8	6.8	12.6

According to Aiyar (2) the composition of a bittern salt is as follows :

NaCl	...	62.1%
Na ₂ SO ₄	...	21.8
Na ₂ CO ₃	...	12.0
NaHCO ₃	...	4.1
TOTAL	...	100.0

Before considering its applicability in leather Industry a few more points regard consideration. The brine that is obtained in Sambhar lake is coloured green which is said to be due to the presence of some organic materials (locally called NIL). It is reported (3) that this green colour deepens as the concentration of the brine increases. At a density of 5°-14°Be no colour change takes place but from 14° to 17° Be the colour changes first to light yellow and subsequently to deep brown. But at this stage the Nil is separated as a thick scum on the surface which can be skimmed out. Again at 20°Be if the Nil is not removed, the colour changes to pink and finally to red with further rise in density.

Mehta & Sapre (4) pointed out that, this colour change takes place due to the action of sunlight on it. The crystallisation of the salt also becomes very difficult if this Nil is not removed earlier. This can be removed by treating the brine with bleaching powder before it is sent for crystallisation. Central Salt Research Institute (1) have worked out some processes by which, they claim, this colouring matter can be completely removed.

Now a days attempts are taken to utilise these bitterns in different ways. One of the convenient means of (1) utilising these bitterns has been to employ them for the production of basic magnesium carbonate. Secondly Sodium sulphate can also be obtained (5) from marine or lake bitterns on evaporation and cooling to -2° to -3°C but such exploitations of the Sambhar bitterns have not yet reached to such a stage so as to make it possible for the separation of its constituting materials in commercial scale. So it was felt necessary to find out its applicability in the hide and skin trade i.e., in curing hide and skin and thereby helping to check this colossal industrial loss at least to a certain extent.

During the period of the last World War, when the supply of the common curing salt fall short of the demand, and as there was no suitable substitute for salting hides and skin, these bitterns are reported to have been used in some localised areas for dry salting goat skins. These bittern salts were obtained from the Sambhar salt lake the Didwana brine wells. But the utilization of these salts for dry salting goat skins was strongly objected by the foreign investigators (6), (7), (8) on the ground that these cured skins were rather practically impossible to soak back to the normal condition. Innes (6) after examining skins found that these skins showed a pH range of 7 to 10. O'Flaherty (7) examining 12 skins confirmed the findings of Innes. O'Flaherty from his microscopical observation found that the collagen fibres of these skins have been damaged due to their high alkalinity. He also tried different chemicals during soaking to get rid of this defect and it was found that NaOH gave better results. He was of opinion that no practical treatment was possible which could be expected to repair the damage done to these skins by the cure. Pankhurst (8) concluded from his experiment that, Indian goat skins dry salted with bitterns showed a reduced ability to rehydrate. It is of course, known (9) that if the skins are dried at higher temperatures, their capacity to reabsorb water will also be diminished with the increase of temperature. According to Pankhurst heat is not the only factor which may produce such detrimental effect on skins during curing. He found that the difficulty in soaking back was greater, the higher the temperature and the Relative Humidity, one of the chief causes, he assumed, of this improper soaking was due to the presence of Sodium sulphate and Sodium carbonate in bittern salts, and which produced some kind of damage to skins during dry salting at elevated temperature and high moisture content.

But on the other hand, Aiyar (2) recommended that bittern salts containing sodium carbonate upto 3% can be used in hide curing. Das (10) was of opinion that bittern salt containing 70% sodium chloride 19% sodium sulphate and 8.5% sodium carbonate is as efficient as ordinary salt under reasonably low temperature conditions.

Pandit & Reddy (11) gave a new and very important indication in this connection. They concluded from their studies on coagulable

proteins that skins cured with excess alkali proved that such skins did rehydrate satisfactorily but this rehydration was accompanied by an appreciable loss of skin substance. It may be however true that the effect of high alkalinity may cause some kind of deformation on the skin structure but it is of doubt whether sodium sulphate, being a neutral salt, has got any adverse effect. A further consideration may be made from the fact that there is no such strong objection on the use of Khari salt in dry salting, which chiefly contains sodium sulphate as its constituents. Lloyd (12) recommended the use of sodium sulphate for curing instead of NaCl. Das; Dhaole & Pal (13) showed that a mixture of anhydrous sodium sulphate and sodium chloride in the proportion of 5 parts to 1 part may be used instead of Khari salt. Although sodium sulphate has got much less bactericidal value than that of common salt, it may indirectly control the bacterial growth due to reduction of moisture uptake of the cured hide at high Relative humidity. Recently it has been found by the authors (14) that sodium sulphate if present with NaCl upto about 50% does not affect the swelling properties of the dry cured hides in the actual process of soaking and liming even at a higher temperature. On the other hand, it was found that Sodium carbonate, if present in the proportion of 2.5% with sodium chloride appreciably affects the alkaline swelling at all temperatures. These factors naturally lead to the conclusion that sodium sulphate present in common salt is not responsible for the decrease in water uptake during soaking.

It can evidently be understood that, bittern salts containing higher percentages of sodium carbonate may be really unsuitable for dry salting. So, to utilize the bitterns in dry salting, either this alkalinity should be neutralised or these carbonates should be removed considerably. The bittern salts may thus be modified or further processed so as to employ this incuring skins.

The following suggestions may be forwarded in this connection for utilization of bittern salts.

(1) As the trouble arises mostly due to the presence of high alkalinity, this may be neutralised by treatment with some acids e.g. H_2SO_4 while in solution. The acid to be added in such mixture may be calculated on the basis of carbonate and bicarbonate present therein.

(2) Instead of neutralising the carbonate, it may be removed from the salt by some processes. The elimination of sodium carbonate from bittern salts may take place by converting it into less soluble salt e.g. Calcium Carbonate with the help of lime. It is also reported (15) that a certain percentage of Sodium Carbonate may be recovered by treating with CO_2 at a certain temperature and pressure. It may not be difficult in near future to find out a suitable method for the recovery and production of Na_2CO_3 from bittern salt.

(3) Dry salting the skins is not the only way to use the bitterns. It can also be used in wet salting the raw hides. It is reported by a number of investigators that the use of soda ash in addition to sodium chloride in the proportion of about 2-4% appreciably increase the curing efficiency of the common salt in many respects. So, in a simple way, if the bittern salts are used in addition to better quality curing salt in the proportion of 5 parts to 1 part or the like, we think, the quality

of the cure will not suffer any set back. Hence its utilization in wet salting may be much more advantageous than that of dry salting.

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Pickling hides and skins—as a method of preservation.

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India exports quite a lot of raw goat skins especially to U.S.A. These skins are sent out in dry salted condition mostly and sometimes in wet salted condition. It has been the experience of the tanners in States that wet salted skins do not reach them in very satisfactory conditions and the dry salting in number of cases is very far from satisfactory. There had been lots of difficulties in this trade owing to certain practices, e.g., when the dry salted skins are sold on measurement basis, it was found that the skins were stretched so much that even the grain got damaged apart from giving a false idea of size. When the weights were specified, it was found that dry salting resulted in plastering the skins with salt and other adulterants. This has been noticed even in Papras (dewoolled sheep skins). To avoid all these and have a fair deal, it was decided to try pickling as a preservative process. New Zealand has been exporting pickled sheep and lamb pelts in large quantities for a number of years. Woodroffe and Caughley have done some exhaustive work and have published their findings on the deterioration of pickled pelts. They have studied in detail the processes that are generally followed by New Zealand manufacturers and have also studied the problem from tanners point of view. Their findings indicate that the damage caused is mainly due to free acid present and it was directly proportional to the free acid present. Various causes of damage due to mould growth, temperature etc. have been studied and they have found that a certain amount of anti-mould added to the pickle liquor

has eliminated this. Also storage temperatures and amount of moisture in the pelt have been studied. It was found that the damage caused was the combined action of the above various factors and steps had to be taken to avoid them all. Best conditions had to be found out suiting our raw material and climate. Certain modifications had to be worked out in co-operation with the buyers so that the skins suited their requirements, e.g. some lots are meant for linings while some others meant for clothing leathers, leathers for purses, wallets etc. The details of these processes had to be worked out. The skins in pickled condition were found to be in a very suitable condition for assortment than skins in hair, i.e. either wet salted or dry salted. Of course from a seller's point of view, this was a source of some more trouble but buyers were assured proper raw material and proper selections. Chief thing was that rejections were completely eliminated out of the lot which was a definite advantage.

It was found that merely pickling did preserve the skins for a considerable time but afterwards some kind of bacterial deterioration got set in affecting the flesh side first and then the grain. Generally the strength of the skins also got reduced. Preservatives like Paranitrophenol were tried and were found to give satisfactory results. Skins pickled and then treated with paranitrophenol kept well for more than a year in a normal raw hide godown. Skins were kept in wooden barrels and some quantity of general process followed was as follows :

Skins after liming suitably, depending on the finished results expected, were delimed and bated well ; deliming was more or less complete only very thick portions showing a faint pink with phenolphthaline. Skins were pickled with 1% sulphuric acid, 6% salt and 90% water. Care was taken to see that the salt used was as clean as possible. Skins after deliming were put in a drum containing the necessary amount of salt and water and drum is started. Skins were run in just salt solution for a couple of minutes and then sulphuric acid added after dilution, in two instalments. Skins were drummed for a period of about two hours and left overnight. Next morning the pH was checked and adjusted to 1.7 to 1.8 and then Paranitrophenol added, run for another one hour or so and then piled up through-out the day and night. Next day, they were assorted and packed in wooden barrels. These barrels were first well cleaned and soaked in pickle liquor and disinfected also. Barrels were packed neatly and some pickle liquor was added to cover the goods. In this condition the goods were exported to States.

Alternately hydrochloric acid was tried with the same process as above but it was reported by the buyers that the skins did not give the same results as sulphuric acid pickle. Of course the exact nature of defects found etc., is not known. Following alternative methods were tried before adapting the process outlined above.

Skins for general purposes were limed as usual for vegetable tanning, i.e., limed with straight lime without any sharpening agents. After pickling, they were tanned and gave satisfactory results but part of the same lot that was kept for about six months or so gave different results. The skins on the whole felt emptier and looked dull and a bit on looser side. When the liming only was changed and sharpened limes were used, this defect got eliminated to a very considerable extent.

It was also observed that short limed skins preserved their tensile strength and tear resistance better than usual vegetable tannage liming even when the tanning process was not changed. Short limed skins were difficult to scud and hence a little low bating had to be adopted. As it was not possible to have any quantitative estimations done, things were judged by actually using the leather for various jobs. The amount of paranitrophenol used had also some effect during vegetable tanning only. Quantities of paranitrophenol did not affect chrome tanning. Some skins were dried up after pickling and then resoaked for tanning. This did not give satisfactory results at all. Skins got soaked after a considerable time but the fibres were not properly opened up and thus gave very poor leather. The colour was also dark. It was found that even distribution of moisture throughout the skins was a factor to be taken note of.

Alum and salt pickle was also tried, but was found to be far from satisfactory. Especially in vegetable tanning, it brought in lot of troubles. Chrome tanning went on more or less satisfactorily. Still the results were not the same as sulphuric acid pickle. There was trouble in storage also. Pelts got deteriorated faster than acid pickle. Pickled and dried out pelts kept better with alum pickle but again the tannage was difficult.

Skins therefore were pickled according to the process outlined above and exported. They were found quite satisfactory by the tanners in States.

Preservation of Hides and Skins.

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Leather Industry is somewhat an extraordinary trade in the sense that its raw material is always a by-product, the supply of which is definitely determined not by the demand in the industry itself, but by the world's consumption of beef, veal and mutton and by cattle mortality. There are a very few raw materials of world's industry and trade which cannot be increased in supply when demand rises. Thus geologists can find out new deposits of metals and work them out when demand needs or cotton and jute may be grown under increased acreage and yield multiplied many times but no one can grow or mine the raw material for leather industry and no amount of planning will increase the supply even when the demand increases manyfold. Therefore it is very imperative that whenever and whatever raw material we get we must preserve it very effectively till they are actually put in processing. Though leather trade is mainly and immediately concerned with the postmortem damages in hides and skins, antimortem damages caused by warble fly, ticks and other pests should also be guarded against very seriously and we must have in India, some organization like IHATIC (International Hide & Allied Trade Improvement Society of Europe) to take care of living animals with the interest of the Leather Trade in view. Though actual figures may not be available to show loss of national wealth sustained by the country due to the damage caused by different pests during living stage of cattles, yet a data on similar damage caused

in U.K. in one year would show what colossal loss such pest may cause and this was estimated as follows :

Overall loss in milk & meat	... £ 8,483,402 and
Overall loss in Hide	... £ 104,400.

If statistical figures were available it would have probably shown that India's case was no exception to this.

Of the postmortem damages involved in hides & skins, the damage caused by bacteria and insects are of greater importance and are, under proper studies, controllable to a large extent. Damage caused by mould attack to raw hides and skins are comparatively less and are not discussed here. Hides and skins when removed from animals are covered with bacteria and will deteriorate if not preserved in some way or other. Since water makes up about $\frac{3}{4}$ th of the hide & skins, the most common practice to preserve is to abstract water from them to such an extent that bacteria cannot grow. The practice of preservation or curing as it is technically called, with common salt serves the function of both abstracting water from hides and skins as well as imparting a strong initial bactericidal effect due to its presence. The salt curing is usually done in two ways: (a) by addition of 35-40% powdered salt on the weight of the hide (wet salting) and by (b) application of strong brine several times and drying the stock after each addition (dry salting). Though such procedures are normally sufficient to preserve the cured stock for a few weeks, occasionally hides and skins appear to spoil within the usual period of preservation in spite of the application of salt and, a shiny, slimy red coat is seen on the flesh side of the hide. This reddening has been called by various names such as 'red-heat,' 'frigorifico reddening,' 'reddening' etc. Though it is not very certain as to whether the very appearance of such coloured patches is, by itself, always detrimental to the quality of hide, yet the stock is classed down with potential decrease in value. Although there has been disagreement about the causative agent of reddening of salted hides, but most investigators agree that this is due to the growth of certain specific bacteria which are probably introduced along with the curing salt. Therefore the question first arises as to how to find out the suitability or otherwise of samples of salt to be used for curing purpose, specially when salts may possess the inherent draw back of introducing such bacteria along with them. It is our experience that the quality of curing common salt may vary from area to area of manufacture and a scrutiny of these salts bacteriologically would bridge up a scientific lacuna in this direction.

Even when curing is done in a proper conventional way the quality of the stock is not expected to remain reasonably good for long time, as it is affected in storage by factors such as environmental humidity, prevailing temperature of storage etc. and also for the fact that certain species of bacteria which are normally present on hides & skins, slowly develop adaptability to high concentrations of salt and subsequently begin to play their harmful activity on salted hides & skins. Control on the humidity and temperature of storage would make the preservation more certain and researches have revealed that preservation is good and lasting if the stock is kept at a Relative Humidity of about 70-80%. At a lower temperature the preservation is still better. It

therefore, certainly requires planning as to how such conditions are to be offered to the Trade as it is feared that a colossal wastage in Leather Trade takes place due to improper curing and/or unsatisfactory storage. Preservation could also be somewhat enhanced by lowering the humidity of the storage still further but as hides are usually sold on the basis of weight, the stockist would not like to lose the weight of his stock by keeping in a lower humidity and consequent abstraction of moisture from it.

Recent researches have shown that addition of certain adjuvants to common salt also increases its curing efficiency. Addition of sodium carbonate (2.5%) and sodium pentachlorophenate (0.2%) or sodium bisulphite (1.5—2.0%) to common salt have shown encouraging results on curing experiments.

Apart from the use of common salt as curing agent, quite a huge amount of a natural deposit found in North India is used for curing. This deposit is known as Khari Salt and is extensively used for curing goat skins exported to U.K. and U.S.A. Its preserving property is somewhat better than common salt and the process is not appreciably affected by variations in humidity. The main drawback of the process is however, presence of about 30-40% earthy matter in Khari salt which imparts a muddy appearance to the cured stock. It also induced the practice of adulteration of the cured stock with more mud so that it may fetch more price on weight basis. There has been a fairly strong agitation among oversea buyers to stop this practice of adulteration. This is only possible if some artificial mixture having the approximate composition of Khari salt without mud is made and used as curing agent. On average Khari salt contains 30-40% each of sodium sulphate and magnesium sulphate besides 30-35% earthy matter. Artificial mixture, on the basis of such compositions, have been used for curing purpose and encouraging results have been reported.

Drying hides and skins in air and sun is another method of curing commonly practiced in India. Though the process is very cheap, yet it has some drawback. It cannot be practised in seasons when humidity is very high and secondly such dried stock is very susceptible to damage by hide beetles. The infestation by hide beetles and subsequent damage caused by them is sometimes very great and it requires a very careful planning as to how to store such stock for a fairly long time. There are quite a number of insecticides in the Trade and it requires a careful study to find out their usefulness. Hexachlorobenzene (B.H.C.) supplied under various trade names has been tested and it has been found that dusting of powder containing 2.5% BHC at the rate of one ounce per 15 sq. ft. of dried hide or skins prevents insect damage satisfactorily.

There are a few salt lakes in India and they yield huge quantity of salt mixture containing more or less 60% sodium chloride 15-20% sodium carbonate-bicarbonate and similar percentage of sodium sulphate.

Attempts have been made in the past to utilize such salt mixture for curing hides and skins, but results obtained therefrom have not been so far very useful. The main drawback being the difficulty to soak such hides and skins back to the required stage. This difficulty in soaking back has been suggested to be due to the carbonate bicarbonate

present in the salt mixture, sodium sulphate having no appreciable action in this direction. Until now the utilization of such salt which is a colossal waste has not received due attention. Formation of a committee like Salting committee or curing and preservation committee as we have in organisations like IHATIS, with co-ordination of attempts by tanners, chemists and bacteriologist to utilize this mixture usefully, certainly requires prompt and careful considerations.

Similarly, due attention has not until now, been paid in preserving stored hides and skins against insect damage done and except by casual application of one or two wellknown insecticides to the stock and leaving it almost to chance. The choice of insecticide, mode of its application, duration of its effectiveness etc. are things which require more than a casual observation.

Preservative Efficiency of Common salt in admixture with Sodium pentachlorophenate.

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The action of the microorganisms on raw hides and skins either on initial stages or during curing and storage may be considered as one of the principal causes for the heavy financial loss in leather Industry. These organisms may cause damages to the hide or skin in a variety of ways e.g. by weakening the fibre structure, loss in hide substance, by reddening the hides and skins, by producing salt stains, by damaging the grain and in many such factors for the growth of the microorganisms, which may be controlled to prevent their growth on hides and skins. Control of moisture content, humidity, temperature of preservation and addition of chemical bactericides etc. are some of such important factors.

There is nothing difficult to understand why the use of common salt is largely adopted throughout the world as the main source of curing agent. It has the advantage of (1) cheapness (2) quick bacteriostatic action and (3) partial dehydration of raw hide or skin. But it is also well known that the bacteriostatic action is not a lasting one specially with the solar salts produced from sea brines, which contain a large number of halophilic organisms. These organisms are liable to grow slowly on cured hide or skin in presence of air and finally damage the cured stock with time. So, naturally, there is a growing demand to find out some suitable additives to common salt which will increase the bacteriostatic and fungicidal action of common salt as well as prevent the growth of red halophilic organisms. Investigations have been carried out in this direction in different parts of world but experiences with all of them are not uniformly encouraging. In our laboratory, we have studied the effect of sodium pentachlorophenate which is both a fungicidal and bactericidal in curing and preserving skins.

Sod. pentachlorophenate has been tried with as an additive to common salt by a number of investigators. White found that Sod. (1) pentachlorophenate is quite efficient in inhibiting the growth of halophilic organisms which can produce grey colony and cause deep pits in salted calf skins. Innes (2) observed that sod. pentachlorophenate in the proportion of 0.2%

(by wt) can inhibit the rancidification in the fats of sheep skins and can (3) maintain the strength of the grain when dressed in the wool. Dempsey reported that in preventing the 'red growth' on skins, sodium pentachlorophenate showed best results. She, on the other hand found that with the pentachlorophenate hides the blood vessels show up unusually and in parts give an impression of some kinds of spots. Dr. Green of B.L.M.R.A. examined the brines five months after use about their sterility and concluded that 0.1% sod. pentachlorophenate caused slight inhibition while with 0.2% the results seemed to suggest slight bacterial growth at the earlier stage but the bacteria dies off subsequently. Williams has pointed out its suitability in Tanning Trade as this preservative covers the processes of salting, soaking, pickling and sammying, moreover it can also be applied to control fermentation and mould growth in tanliquors. Dempsey, Haines, Raymond (5) opined that sod. pentachlorophenate could be successfully applied with common salt in the proportion of 0.1% (by wt.) to prevent the deterioration of Indian goat skins caused by 'red heat' organisms. But Stuart & Frey (6) from their experimental data concluded that sod. pentachlor. phenate even in a concentration of 0.5% was not very efficient. They found no increase of preservative efficiency of common salt when sod. pentachlorophenate was added in the proportion of 0.2%. The overall effect of sod. pentachlorophenate on the organisms is definitely not great enough to prevent their growth in the concentrations studied. They also indicated from small scale experiments that sod. pentachlorophenate might be slightly safer from the stand point of protein fixation than the other chlorophenols like sod. trichlorophenate in higher concentration. So, it was felt necessary to study further, whether sod. pentachlorophenate could be used in hide curing with greater effectiveness in higher concentrations.

Experimental Procedure:

Sheep skin freshly taken from slaughter house, washed well adhering flesh removed and cut into test pieces. The skin pieces were then cured with 40% common salt having sodium pentachlorophenate in admixture with it in the following proportions.

(1) 0.5% (2) 1.0% (3) 1.5% (4) 2.0% with one control having no pentachlorophenate. The cured skins were then kept in storage at about 30 C in a moist condition. Observations were taken during this period regarding the growth of 'red heat' organisms, hairslip, smell etc. After about 14 weeks preservation the skin pieces were taken and put to process. These were finished as vegetable tanned lining leather. The limed and tanned yield were noted. No attempt was made in increasing the yields. The observations taken during these 14 weeks of preservation are represented in Table I. The limed yield (2 days sulphide lime and 5 days fresh lime) calculated on the raw weight are given in table II, Table III denotes the tanned yield calculated on the raw weight.

Table I
Observations during Storage at 30°C

% Pent. chl. phosphate.	Bacterial Growth				Hair slip				Smell.			
	3rd week.	6th week.	10th week.	14th week.	3rd week.	6th week.	10th week.	14th week.	3rd week.	6th week.	10th week.	14th week.
Con-rol.	Considerable red growth was observed on the flesh side.	Heavy red growth throughout the entire surface.	Same as in 6th week.	No appreciable change.	No hair slip.	Hair slips.	Hair slips.	Hair slips.	Good	Not good.	Bad smell.	Bad smell.
0.5	Slight red growth was observed at the edges.	Growth at the edges and also little growth in different parts.	Same as 6th week ; only with little increase in growth.	do	do	No hair slip.	No hair slip.	Little hair slip.	Good	Good	Good	Good
1.0	Slight red growth at the edges.	do	do	do	do	do	do	Very slight hair slip.	do	do	do	do
1.5	Practically no red growth.	Little growth at the edges.	do	do	do	do	do	do	do	do	do	do
2.0	do	do	do	do	do	do	do	Practically on hair slip.	do	do	do	do

Table II

Percent pentachlorophenate.	Yield calculated on raw weight (%)
Control	38.58
0.5	60.99
1.0	65.08
1.5	70.63
2.0	70.97

Table III

Percent Pentachlorophenate.	Yield on raw weight (%)
Control	18.43
0.5	21.47
1.0	20.56
1.5	22.40
2.0	21.77

Discussion:

The observations represented in Table I clearly indicate the effectiveness of sod-pentachlorophenate in preserving skins. The growth of the 'red heat' organisms is found to be appreciably prevented by the addition of pentachlorophenate specially when high percentages are used. The first sign of putrefaction, as indicated by hair slip has occurred in the case of control after 6 weeks only. But in the case of 0.5% pentachlorophenate 'hair-slip' has just started after 14 weeks and in the cases of higher percentages practically no 'hair-slip' has taken place. So, it can be seen that by adding 0.5% pentachlorophenate to common salt its preservative efficiency can be increased by about $2\frac{1}{2}$ fold and by adding higher percentages for some more periods. The result of our experiment with sod-pentachlorophenate is comparatively better than that of Stuart & Frey. But our observations also differ from the findings of Dempsey & co-workers regarding the prevention of red growth. Even with 2.0% of pentachlorophenate the growth of red heat could not be prevented entirely, under our experimental conditions.

From table II it can be found that the limed yield is minimum in the case of control, whereas, it increases, slightly with the increase of percentage of sod. pentachlorophenate.

The figures of table III show that the tanned yield is much less in the case of control. But with addition of pentachlorophenate in increasing proportions, the yield is roughly the same i.e. even with increasing

proportion of pentachlorophenate the yield of leather does not increase appreciably after this 14 weeks of preservation. So considering the cost of this material, 0.5% of pentachlorophenate on the salt weight or 0.2% on the raw weight may be considered beneficial to add with common salt for better preservation.

Although sod-pentachlorophenate is not a strong poison like so many other bactericides, still some precautions are necessary in handling it. The dust of sod. pentachlorophenate is irritating to the mucous membranes and the contact of the material either solid or in solution with skin should be avoided.

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Discussion on curing and preservation of Hides

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(1) Uniform Standard of Curing:

Raw hides to be prescribed giving exact specifications, when the hides to be treated, how many times salt to be applied and what quantity of salt to be used, how much free salt the hide can contain on the total weight of hides.

(2) Kind of Salt:

To be used—their chemical specification Trade mark and specification for grain of salt.

(3) Other curing Agents:

Specification for Khari salt and the way of preparation. The question if Khari salt can be used for curing wet-salted Chrome Cow Hides.

(4) Preservation of hides during summer months:

Besides salt and Khari salt what other chemical agents can be used for improved preservation of the hides. This specially applies during summer time or storing winter hides in wet-salted condition for at least in the months of April and May.

(5) Wrong practices of curing of hides:

(a) Some beoparies keep the hides in the sun in green condition giving them quick dry surface in view to retain the lymph to achieve better weight after salting. This is a very dangerous practice and the hides are liable to putrefaction and the fibres generally become weakened.

(6) Damages by Butcher cuts:

Unfortunately, the small percentage of hides which are obtained from Slaughter house for the honest manufacture of shoes are damaged by flaying marks.

These defects are increasing most probably due to the reasons which are mentioned in the General Review but also due to lack of interest of the beoparies to find and point out to the butcher when the hides are brought to them for sale.

(7) Supply of salt to the Beoparies:

There are a lot of adulteration and insufficient curing from the simple point of view that the beoparies just could not get the salt and this especially during summer time when the movement of grain is taking all the priority. This is causing huge damages which could have been easily avoided provided the Railway authorities will take more care and accept salt in the topmost priority when offered for booking especially when it is for this purpose.

(8) General Review of the trade:

Our organisation is covering most important areas where trade of hides is mostly concentrated due to its areas producing good quality of hides, like Bihar, U.P. It is very regrettable that the quality of hides is deteriorating from season to season. The reason for this is due to anti-slaughter campaign and the legislation imposed, the trade of hides become some where some times impossible. The legislation of different Governments restrictions in respect of slaughtering are misutilised by certain organisations and by certain people. This itself is very serious handicap. The worst thing is certain individuals, who simply intend to harm the trade, are misutilising the restrictions. The consequences are disastrous as even the slaughtering of the animals,

which is legally permitted, has to be done sometimes secretly and on the places far from locality and often at night. Shortest possible time for skinning of the animals are taken and thus butcher cuts, which are in the increasing scale, are so frequent and damaging practically every piece of hide brought to the market at present.

It is also not possible to cure the hides in time and they are sometimes lying many days unattended. Naturally such hides are brought to the dealers for curing and become practically worthless for any purpose.

It is no doubt that this situation is causing great harm to the trade.

There is lack of organisation for skinning of the dead animals and a lot of National Wealth is devoured by the vultures, who are the first to attend on the carcasses. The damages to the hides by vultures are very common and some times they are even completely eaten by them.

It would be interesting to study this problem and find out how many pieces actually from the dead animals are coming to the market and how many of them are not able to reach the market at present. We are sure damages on these hides must be a serious loss to the leather trade and industry which means as well loss to the National wealth. Even those hides coming to the beoparies are still completely damaged due to lack of transport as due to booking restriction from time to time, it is causing accumulation of hides in the mofussil and rotting them as there are no proper facilities for storing of the hides anywhere. Thus good hides brought to the beoparies are sometimes completely damaged due to unavailability of transport.

Movement of wagons and facilities in the wagons are most inadequate. There are only iron wagons available for transport which are very often standing in some yards for many days containing hides and it is natural especially during summer. The hides could not stand the unbearable heat created especially when wagons stand in the scorching sun.

A lot of damages could have been avoided provided this is taken seriously into consideration by all concerned from the Burcher to the Tanner and as well if all of them can be impressed sufficiently the loss which the National Economy is suffering and also the Government authorities concerned so that remedy can be found early and speedily.

If air-conditioned wagons are beyond the financial possibilities some kind of wood line wagons can be provided so that the wet-salted hides will not come in contact with iron which is one of the worst enemy of the Tanners, especially where vegetable tanning is concerned.

Facilities of storage of hides in the Arathdars' godowns to be improved and it is really regretted that till now no improvement whatsoever is made not only in the central market of raw hides but we could see that deterioration and less care is given to the hides from day to day.

As our purchases are mostly done in mofussil we could see that the small people, who are doing business with hides, are more conscious of

their duties in respect of curing and storage of hides and some times they are depriving themselves of the comfort to give better protection to the hides especially when the weather is unfavourable. It is not always that this is done. Just from the point of view that they will suffer huge financial loss ; but many times it is done simply from their consciousness not to permit the hides to get any damage. Unfortunately this example can be found mostly with the small dealers but the hides during transport and storage in the central market do not get proper facilities or such hides are used just to be mixed up with inferior quality of hides. This practice is also responsible that those small beoparies who are doing the best of their jobs are not rewarded properly and their hides are fetching them the same price with those beoparies who are neglecting the hides and giving them treatment with adulterated salt for the purpose of reducing the cost of hides and competing in the market.

Many of the above defects could be solved and improvement achieved without spending any money whatsoever provided all those defects are realised by those who are in the trade and if they will look more of their own interest. But due to lack of realisation on their part the National Economy is suffering huge loss.

The general complaint of the Tanners including ours is that the hides are deteriorating in quality and those tanners who are still able to export leathers outside are losing the confidence as the quality of their product is becoming poorer and poorer from lot to lot.

It is hoped that all the points given here will be seriously discussed and remedy found out with a view to promote improvement in the trade.

Some aspects of the Biochemistry of Raw Hides and Skins

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The "Biochemistry of Raw Hides and Skins" is a very vast subject. It will not be possible for me to do full justice to this subject within the time at my disposal. I shall therefore touch only a few important aspects with special reference to our researches carried out at the Biochemistry Laboratory of this Institute.

Animal skin is composed of a number of distinct tissues viz., epithelial, connective, muscular, nervous, glandular, adipose and blood tissues. It also contains a number of distinct organs, viz., voluntary and involuntary muscles, sebaceous and sweat glands, nerves and blood vessels. These various tissues and organs are most intimately connected with a number of physiological functions of the skin and are, therefore, of very great importance. For example, one of the main functions of the skin is to maintain the body-temperature constant by removing extra heat through sweat glands, or by retaining required amount of heat by means of the fat glands.

Raw hides and skins present an intensely interesting subject to a biochemist for planning his researches, academic as well as applied, on proteins, lipids, carbohydrates and enzymes, because animal skin or hide, like other tissues of the body, is essentially composed of these constituents. During the past two decades, there has been an important advancement of our knowledge on the composition of skins and hides with particular reference to their protein and lipid constituents and their biochemical characteristics. Approximately 35 per cent of the weight of fresh skin or hide is made up of proteins. The important proteins of skins and hides are collagen, reticulin, elastin and keratin, which are fibrous in nature and albumin, globulin and mucoids, which are non-fibrous, globular proteins. Besides these main proteins, the muscle fibres are made up of several proteins of which myosin and myogen are predominant.

The classification of the skin proteins into the two main types, viz., fibrous and globular, reflects on their essential functions and properties. For example the globular proteins are usually more intimately

involved with the various physiological and metabolic processes of the body, whereas, the fibrous proteins are generally connected with the various structural and protective elements of the body, e.g., cartilage, tendon, ligament, muscle, nail, hair, etc. These two types of proteins possess characteristic properties in accordance with the requirements of their respective functions. For example, the globular proteins are usually soluble in water or in dilute salt solutions, whereas the fibrous proteins are insoluble in such systems.

From the standpoint of leather manufacture, collagen is the most important protein in the skin, because it reacts with tanning agents to form leather and is present in the largest amount, approximately 30% of the weight of the whole fresh skin being collagen. The keratinous and the globular proteins are removed during the processes before tanning. The technique of leather manufacture lies in removing as far as possible the undesirable properties and in augmenting the desirable ones of the various proteins of the skin. In the process of manufacture of leather, therefore, skins or hides are subjected to various treatments which bring about the necessary changes in their protein constituents. A thorough understanding of the characteristic properties of the various skin proteins and also of the mechanisms by which they are acted upon by various types of pretanning and tanning agents is therefore, the essential basis for the scientific understanding of the art of leather manufacture.

Our attention was, therefore, principally concentrated on the researches on the isolation of various proteins from skins and hides and on their important properties and reactions. The available methods were suitably modified and standardised for the preparation of eight proteins^{1,2} in pure form from skins and hides. For example, collagen was prepared from the butt portion of a fresh buffalo hide. Reticulin was prepared from a fresh calf-skin. Elastin was prepared from *Ligamentum nuchae* from the neck of a cow, obtained fresh from the slaughter house. Keratin was prepared from the wool of a fresh sheep skin. Albumin, globulin and mucoids were prepared from a goatskin which was obtained fresh from the slaughter house. Myosin was prepared

from the fleshings of a freshly flayed buffalo-hide. Each protein prepared was characterised by determinations of total nitrogen and total sulphur and by certain colour reactions.

Although most of the component amino-acids of collagen, elastin and wool were reported by a number of workers, the information with regard to the quantitative analysis of all the component amino acids is not quite complete. No quantitative assay of the component amino acids of reticulin, albumin, globulin, mucoids or myosin, prepared from skins and hides was reported. In the Biochemistry Laboratory of this Institute, therefore, a systematic investigation was undertaken on the complete quantitative analysis of each of these proteins for component amino acids by means of the recent technique of two-dimensional paper chromatography and the results obtained have now been reported². Researches are also in progress on the identification as well as quantitative estimation of terminal amino acids in each of these proteins by making use of the recent techniques. Adequate study of the terminal amino acids in proteins may unravel their amino-acid sequence and may provide a chemical means of testing some of the hypotheses of their peptide arrangement.

During recent years, several findings regarding the existence of soluble collagens and soluble keratins in animal skins have been reported. Rudall³ prepared a soluble protein by extraction of the epidermis with 6M urea solution and obtained the fibrous keratin from the extract by precipitation at pH 5.5, which was named "Epidermin". Epidermin was considered⁴ to be a pre-keratin or soluble precursor of keratin. A group of Russian workers⁵ prepared a soluble collagen by extraction of minced, phosphate extracted animal skins with citrate buffer at pH 4 and separating out the protein from the extract by dialysis, neutralisation or salting out. They found larger concentrations of soluble collagen in young tissue than in old. They considered it to be a biochemical precursor of collagen and termed it "procollagen". Highberger⁶ and his colleagues obtained soluble collagen by extracting the skin with neutral or mildly alkaline salt solutions. They⁷ also observed that fibrous collagen could be prepared from soluble collagen by the addition of small amounts of certain inducing agents. They⁸ considered that soluble collagen consists of kinetic unit particles which were capable of turning into fibrous collagen and which were called "tropocollagen". They⁹ also suggested that the tropocollagen particle is a precursor in the physiological fibrogenesis of collagen. Systematic researches are in progress in the Biochemistry Laboratory of this Institute to investigate the nature and biochemical characteristics of the soluble forms of these fibrous proteins.

Reports are also available on the existence of α -keratin and β -keratin, α -elastin and β -elastin. The keratins of feather apparently exist largely in the β -form in the native state. The transformation of α -keratin to the β -form may also be possible by suitable treatments of the fibre. These α - and β -proteins may be prepared from the parent protein extract by suitable methods of fractionation. Fractionation of the oxalic acid extract of elastin powder was found¹⁰ to give α - and β -elastins having markedly different physical properties. However, the chemical studies carried out by Partridge and Davis¹¹ showed that the amino acid composition of the original elastin and the two fractions derived from

it was closely similar. It, therefore, appears that the intact fibrous elastin may be regarded as substantially homogeneous. Researches are in progress in similar lines in the Biochemistry Laboratory of this Institute.

Very recently, Burton¹² and his colleagues have reported that collagen fibrils when treated with borate buffers of pH 7 to 10.4 at 37°C. for about 40 hours were apparently transformed into structures closely resembling elastin fibres. Similar fibres resembling elastin were also obtained following the treatment of collagen with 1 per cent sodium metaperiodate in phthalate buffer of pH 5 at 37°C. for 1 to 6 hours. Incubation of collagen with trypsin and chymotrypsin in phosphate buffer of pH 7.3 at 37°C. for 3 to 24 hours also produced elastin-like structures. Biochemical studies showed that the treatment of the collagen fibrils with alkaline buffer removed fractions of high hydroxyproline and arginine content of collagen and also the large amount of polysaccharide material. It appears, therefore, the transformation of collagen into elastin involves a deep-seated and complex breakdown of some of the polypeptide chains of collagen. It was also reported by them¹² that incubation of elastin with collagenase at 37°C. produced collagen-like fibrils which were in turn completely digested by the enzyme. It appears that further evidences may be required to confirm these very interesting observations.

Skin mucoids offer a very fascinating subject for biochemical investigations. They exhibit both protein and carbohydrate functions. They have been found² to contain 19 amino-acids, about 12 per cent nitrogen and 3.9 per cent sulphur. They give a strongly positive Molisch reaction which indicates that a considerable amount of carbohydrate is present in mucoids. The total carbohydrate content of skin mucoids has been reported² to be of the order of about 20 per cent. Two mucopolysaccharides, viz., hyaluronic acid and chondroitin sulphate have so far been identified in mucoids. The other carbohydrate constituents of skin mucoids are reported to be glucose, galactose and hexosamines. No free reducing sugars are, however, present, as Fehling's solution is not reduced by skin mucoids until after hydrolysis with acid or amylolytic enzymes. The acid hydrolysis of the mucoids has been reported¹³ to liberate equimolecular amounts of glucose and galactose. The hydrolysis of skin mucoids by diastase or amylase has been shown¹ to liberate appreciable amount of reducing sugars. The skin mucoids may be considered as some sort of protein-carbohydrate complex the exact nature and complete composition of which may be established only after more detailed investigation. Systematic researches in this direction are in progress in the Biochemistry Laboratory of this Institute.

In addition to the carbohydrate constituents of skin mucoids, other carbohydrates are also present in skins and hides. These carbohydrates exist either as free glucose and glycogen or as integral parts of proteins and lipids. The glycogen which is a polymerized form of glucose is used by the body as a reserve store of food. The presence in cattle hides of galactose-mannose and fucose containing carbohydrates has also been reported¹⁴. The important sources of bound carbohydrate in skins and hides are not only the mucoids but also the other proteins, viz., collagen, albumin, globulin, reticulin and elastin. It has been reported^{15, 16} that collagen contains about 0.65 per cent

carbohydrate composed of glucose and galactose. Other carbohydrates, viz., mannose, fucose and glucosamine have also been found^{17, 18, 19} to be present in smaller amounts in collagen. Skin albumin or globulin has been shown¹⁵ to contain about 2.2 per cent carbohydrate complex consisting of mannose and galactose. Recently it has been reported¹⁸ that reticular tissues contain carbohydrate composed of glucose, galactose, mannose and fucose. It has also been shown¹¹ that elastin contains about 0.1 per cent amino-sugars.

The lipid constituents of skins and hides are of great biochemical interest. The lipid content of animal skins varies greatly from species to species and even from individual to individual of the same species and depends upon a number of factors, particularly, age, sex and the dietary habits of the animal. A large volume of work has been reported on the lipid constituents of skins and hides. Koppenhoefer^{20, 22}, and Koppenhoefer and Highberger²³ reported detailed analytical data on the estimation of the principal components of the lipids of the epidermal area, the corium and the subcutaneous layer of steer hide, goat and sheep skins. In summarising some of the typical results, the total lipids of the epidermal area of steer hide were found to contain about 20% phospholipids composed of mainly lecithin, cephalin and sphingomyelin, about 15 per cent cholesterol, about 10 per cent free fatty acids and about 35 per cent waxes. Recently, the presence of appreciable amounts of low molecular weight volatile fatty acids in the epidermal lipids of sheep, goat and cattle skins has been reported^{22, 24}. The lipids of the corium are comparable to the lipids of the subcutaneous adipose layer in many respects. The adipose fats and the corium fats represent the reserve deposits of the animals. Both adipose and corium lipids are mainly composed of triglycerides. The fatty acids of these triglycerides of steer hide and goat and sheep skins have been found to be predominantly palmitic, stearic, oleic and linoleic acids. The corium lipids of the skins of these animals have been shown to contain small percentages of cholesterol and phospholipids composed of mainly lecithin. Traces of phospholipids and cholesterol are present in the subcutaneous lipids of skins. The different classes of lipids of skins and hides play an important role in their normal physiological functions. Researches on the biochemistry of skin lipids with particular reference to their detailed fatty acids composition and reactions of lipolytic enzymes are in progress in the Biochemistry Laboratory of this Institute.

Many enzymes have been found to occur in skins and hides. The concentration of the enzymes in skins is, however, much smaller than in other tissues of the body. The chief proteolytic enzyme which is responsible for the autolysis of skins and hides and their postmortem changes in the absence of any bacterial action is cathepsin. Other enzymes which have been shown to be present in skins are peptidase,²⁵ dipeptidase²⁶, nucleotidase²⁷, and arginase²⁸. Lipolytic enzymes like lipase, lecithinase and cholesterol esterase have also been found²⁹⁻²⁵ in skins. Amylase²⁶ also has been reported to occur in skins. Catalase³⁰ and oxidases have also been shown to be present in skins. Dopa oxidase of the skin is responsible for the formation of melanines which are known to be the chromogenic substances of skin pigments. It has been reported³¹ that when the tyrosinase which is present in the skin is activated by ultraviolet light, it is capable of converting tyrosine into dihydroxyphenylalanine (dopa) which in turn is oxidised into melanines

by the action of dopa oxidase of the skin. This appears to be one of the causes of the darkening of the skin by the prolonged action of sunlight.

As regards our researches on the enzymatic reactions with skins and hides, the reactions of a number of proteolytic and amylolytic enzymes on skins and hides have been systematically investigated with particular reference to enzymic unhairing and bating. The proteolytic enzyme prepared from the latex of madar plants (*Calotropis gigantea*) has been found³² to react readily with skins and hides and is capable of unhairing them within 24 hours. The proteases isolated from certain molds of the *Aspergillus* group have also been found to unhair skins and hides within one to three days depending upon the atmospheric temperature. These enzymes have also been found³³⁻³⁵ to be capable of bating unhaird pelts very satisfactorily. It has also been demonstrated³⁶⁻³⁷ that certain amylolytic enzymes are capable of reacting with skins and hides and of unhairing them in three days. The reactions of these proteolytic and amylolytic enzymes have been systematically investigated¹ on the individual proteins isolated from skins and hides. It has been observed¹ that the skins mucoids are readily hydrolysed by the proteolytic enzymes with liberation of amino acids and by the amylolytic enzymes with the liberation of reducing sugars. Such an investigation has thrown some light on the possible mechanism of enzymic unhairing of skins and hides and has confirmed the earlier findings of Burton, Reed and Flint.³⁷ It appears that the enzymic unhairing by proteolytic or amylolytic enzymes depends more or less on the hydrolysis and removal of mucoid materials. Mucoids are distributed throughout hides and skins especially at the epidermal-corium junction and around the hair follicles. Naturally, when the mucoids are hydrolysed and removed, the hair-roots are weakened and ultimately the hairs become loose.

Researches are also in progress on the factors responsible for the natural putrefaction of skin proteins and the nature of the various decomposition products. It is a common observation that skins or hides are highly susceptible to natural putrefaction. Natural putrefaction may be said to be a purely enzymatic digestion. The splitting of proteins into various decomposition products is an important reaction in the putrefaction of skins and hides. When a raw skin or hide is exposed to atmospheric conditions, it is quite possible that it may be contaminated with a number of protein-destructive bacteria which may secrete various types of proteases and amidases which in turn may act upon proteins and amino acids forming various decomposition products. In normal hydrolysis of a protein by a proteolytic enzyme, amino acids are formed. In natural degeneration or putrefaction of proteins, however, the end products are usually other than amino acids, because, amino acids themselves are acted upon by amidases resulting finally in the formation of various other decomposition products and in the liberation of malodorous gases. It appears that the end products of putrefaction may be various substances depending upon the type of enzymes secreted by the bacteria present, temperature, moisture and several other environmental conditions. The exact nature of the various types of end products formed is not definitely known. It has been reported³⁸ that a number of substances, viz., ammonia and various amines; volatile acids comprising the acetic acid

series; aromatic acids and oxyacids; phenol, indole, scatole, pyrol and their derivatives and mercaptans and other sulphur-like bodies etc. may appear as end products of the putrefaction of proteins.

Numerous other aspects of the biochemistry of hides and skins remain to be presented. Time, however, does not permit the discussion of any other aspect of this vast subject. There is immense scope for conducting systematic researches in this very important field.

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Studies on the prevention of insect damage to Hides and Skins.

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The Indian Hide and Skin Industry suffers much loss due to the ravages of insect pests. Different species of insects have been recorded from stored hides and skins from time to time, of which the beetles of the *Dermestes* species alone have formed a major proportion. Recently the larvi of the species *Anthrenus vorax*, also belonging to the family of Dermestid beetles were recorded in this institute (fig. 1). The study of the nature of damage caused by these larvi to flint dried cow hide, revealed that the grain surface was badly damaged. Leather samples from damaged hide pieces when tanned and finished showed substantial damage to the grain surface as the grain was pitted and coarse. The larval forms of this insect appear to feed on hairs and wool, and were first seen to occur on flint dried cow hide. The authors have also observed these larvi on salt-cured cow hides and goat skins, as well as on leathers (cow and buffalo) finished with the hair on. This beetle



Fig. 1.

Photograph of hide piece showing the larval forms of *Anthrenus Vorax*, at the site of damage.

has been recognised as a pest of finished leather in the tropics² and has also been recorded as a pest of skins, leather, carpets etc. ^{3,4} in India even as early as 1896.

It is not possible to assess the loss sustained by the Indian leather industry on account of this insect pest as at present data regarding the incidence of this pest on hides and skins are not available. It may, however, be visualised that owing to the ease with which this pest has been recorded in our laboratory, it must be present elsewhere also. The necessity has therefore arisen to work out suitable control measures to prevent the damage by this insect.

Different methods are available for the control of insects on hides and skins of which Arsenication appears to be the most commonly followed one, in our country ^{5,6}. Certain other chemicals as Naphthalene ^{7,8}, Ortho and Para dichloro benzene ^{9,10}, Sodium silico fluoride ^{11,16} and Nicotine sulphate ¹⁷, have also been found useful in the control of insect pests associated with hides and skins. Curing hides by wet salting itself has been shown to be a good method of preventing such damage ^{18,19}. Of recent years Gammexane and D.D.T. have been found to be of immense help in the control of beetles and other insect pests ^{20,25}. Soni ¹⁹ recommends the use of a 2.5% Gammexane for controlling hide beetles in India.

In this laboratory Gammexane (containing Benzenehexachloride) has given encouraging results in the control of the larval forms of the beetle *Anthrenus vorax*. This chemical has the additional advantage, in that it can be applied in the form of dust, which would obviate the need for dipping the hides and skins in any solution as is done in arsenication and also the consequent need to redry the same. Further arsenication exposes the hides and skins to the risk of putrefaction, should they be improperly dried, particularly in the rainy season. Further the workers are also exposed to the danger of arsenic poisoning.

Experimental

Different concentrations of Gammexane (B.H.C.) in talc were applied to hide pieces in similar proportions, and these hide pieces were exposed to the attack of known number of *A. vorax* larvi. Six hide pieces, each half a square foot in area, were cut out from a flint dried cow hide. The following concentrations of Gammexane in talc, namely 10%, 7.5%, 5%, 2.5%, and 1% respectively were applied to five of these hide pieces, at a uniform rate of one ounce per hide of 15 s.q. feet. The sixth piece served as control and as such did not receive any treatment. Six glass jars were taken at the bottom of each of which ten laboratory bred larvi of the above beetle were kept. The jars were appropriately marked and one hide piece was kept in each of these jars. The larvi were thus given easy access to the hide piece. In each case about 3/4th of the quantity of the dust was applied by hand rubbing on the hairy surface while the remaining part was applied to the flesh side. All the jars were closed by lids to prevent the escape of the larvae and also to retain any fumigant action of the insecticide. Day to day observations were made to determine any mortality to the larvi, as well as to note whether any damage has been produced to the hides. The larvi were treated as dead when they failed to show any response to needle stimulation. The larvi were however observed for some days

before they were definitely classed as dead. The results of these observations are represented in the following table and graph. (Fig. 2).

Table showing the effect of different concentrations of Gammexane on the larvi of *A. Vorax* and on the prevention of damage to hides.*

Concentration of B H C. in dust.	Observations on Larvi.	Evidence of Damage to hide.
10%	All 10 larvi found motionless by 24 hours and dead by third day.	No damage to hide.
7.5%	7 found motionless and 3 feeble on 3rd day, 8 found dead by 4th day, and all 10 found dead by 5th day.	do.
5%	7 found dead by 7th day and all 10 dead by 13th day.	do.
2.5%	6 found dead by 7th day, 8 found dead by 14th day, and all 10 found dead by 16th day.	do.
1%	2 dead by 7th day, 5 by 14th day, 6 by 24th day—but no further mortality up to 30 days and over.	Hide damaged. Damage started on 10th day.
Control without insecticide.	All larvi found alive. No mortality.	Damage progressive.

*Summary of two trials.

A perusal of the table and the graph, shows that a concentration of 10% B.H.C. was quite rapid in producing the death of the larvi i.e. within 2 days. With decreasing concentrations up to 2½% B.H.C. there was a progressive reduction in the destructive power of this insecticide. In all the above cases no damage was noticeable in the test hide pieces. Thus though the larvi lived for some time in some concentrations they did not cause any damage to the hides. At a concentration of 1% B.H.C. only some of the larvi were found to be killed (60%), while the remaining ones got upon the hide and damaged it. These larvi were found to be alive and active even after a month.

Arsenication of Hides:

Along with the above trials, a piece of hide was arsenicated by immersing it in a 0.25% solution of sodium arsenite (for one minute either side). Subsequent to drying this piece was also subjected to the attack of these larvi. This hide piece was found damaged and the larvi were quite active on it at the end of a month.

MORTALITY RATE OF A vorax LARVAE AND B.H.C. CONTENT

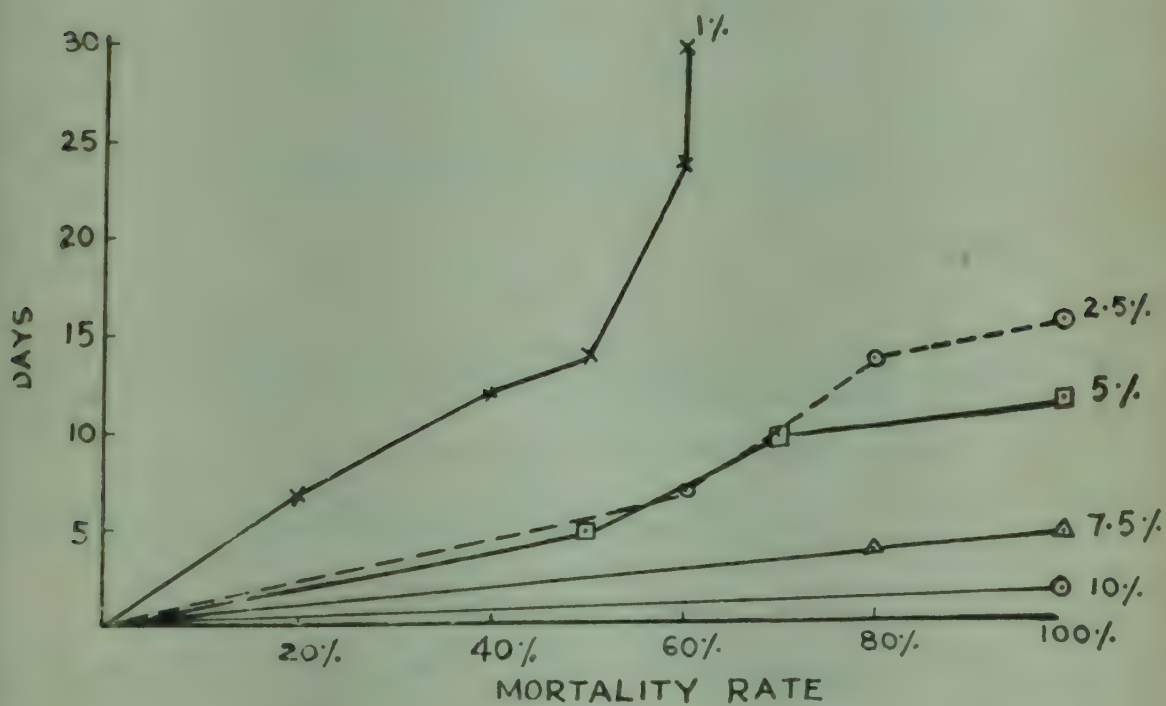


Fig. 2.

Discussion :

The favourable results obtained with Gammexane (B.H.C.) in the prevention of damage to hides, in these trials, are in keeping with the results obtained by earlier workers in this field ¹⁹⁻²². Dusts having a B.H.C. content of 2.5% and above proved satisfactory when applied at the rate of 1 ounce per hide (of 15 Sq.ft. area). It will be seen that $\frac{3}{4}$ of this amount was applied to the hairy side while the remaining amount was applied to the flesh side. This procedure was adopted, in view of the fact that in an earlier trial (unpublished data) where the dust was applied only to the hairy surface of the hide, the larvi tried to avoid the gammexaned side, by taking shelter under the flesh side of the hide. In practice it may not be necessary to dust the flesh side, if the flesh side of one hide is made to rest on the hairy side of the subsequent one. With regard to arsenication, the single trial with this insect, revealed that it was not quite satisfactory. In this connection the observation of Furlong⁶ appears interesting. He stated that, "The strength of arsenic solution employed and the time of immersion vary in practice, and no organised investigations have been conducted so far to determine the most satisfactory procedure." This might probably explain the inadequacy of this method in these trials. Thus a systematic study of the process of arsenication deserves consideration. In view of the encouraging results obtained with gammexane, it deserves to be tried on a large scale on hides and skins.

Summary

(1) Laboratory trials with gammexane dusts having a Benzene hexachloride content of 10%, 7.5%, 2.5% and 1% at a rate of one ounce per cow hide, proved useful in the prevention of damage by larval forms of *A. Vorax* in strengths above 2.5% only.

(2) The insecticidal power of these dusts varied directly with their B.H.C. content.

(3) At a strength of 1% the dust did not give full protection as only some larvi were killed, while the others that survived subsequently damaged the hide.

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Histological study of the effect of postmortem changes on the leather forming qualities of calf skin

by

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Abstract : Postmortem changes taking place in uncured Calf skin under Indian climatic condition has been studied, and the effect of putrefactive processes on the physical properties of chrome tanned leather has been shown.

Hides and skins, the basic raw materials for leather industry, are highly susceptible to the attack of micro-organisms which readily set up processes of putrefaction, and reduce their leather forming qualities, if not preserved properly. Micro-organisms are omnipresent, and all hides and skins carry with them great numbers of these micro-organisms which during the life time of the animal generally do not damage owing partly to the protection of epidermis and partly to the body resistance. After the death of the animal, these defences do not work and hence under favourable conditions these micro-organisms become active and penetrate into skin tissues breaking down the non-fibrous and fibrous proteins of the hides and skins, causing thereby irreparable damage to the raw materials. It is a common knowledge that warmth, moisture and high humidity usually favour the multiplication of micro-organisms whereas cold and dryness hinder it. It is therefore obvious that in cold climate hides and skins can be kept in uncured condition for a longer period than the tropical climate like India.

Of the micro-organisms, the gelatine liquefiers or proteolytic bacteria are the main concern of the tanners, because they also attack

the leather forming tissue of hides and skins. The nature of bacterial penetration and degree of protein decomposition in uncured hides and skins have been reported by a number of workers including Tisser and Martin¹, Shuttleworth², Koppenhoefer and Somer³, Stuart⁴, Raymond⁵, Kaye⁶, Dempsey⁷, and Nandy et al⁸. The effect of putrefactive processes in raw hide upon finished sole bends were also reported by the British Leather Manufacturers' Research Association. The results of the above workers have revealed that degenerative changes in unpreserved ox hide take place as early as five hours after the death of the animal, and that cellular components and young keratins at the hair roots are readily affected; the reticular tissue is also weakened and splitting up of collagen fibre bundles is increased. The above findings however do not throw sufficient light either to the nature of damage caused to collagenous tissue at the earlier stages of staling period or to the effect of the putrefactive processes on the physical properties of upper leather made from tainted hides and skins. A histological study to collect the above informations which is the subject matter of this paper, was therefore undertaken with a calf skin under Indian climatic condition.

To determine the staling period, a preliminary study was made with a piece from a calf skin taken immediately after slaughtering and left in uncured condition at the room temperature varying between 28° and 31°C in a moist chamber. Samples were taken at regular intervals during the staling period for histological study. This preliminary study revealed that all the fibrous tissues of the skin are heavily affected within the period of 72 hours. The main experiment was then undertaken in which the butt portion of a slaughtered calf skin was cut into a number of pieces each measuring 3"x6" which were then left uncured without preliminary washing at room temperature varying between 28°-31°C in a moist chamber. At the interval of 12 hours the concerned experimental piece was removed, a portion cut from it and preserved for histological study and the balance put into process for chrome tanning. The total staling period covered 72 hours. All the pieces were put through the same tanning and finishing processes. Microscopical slides were prepared from all the preserved pieces for histological examination and samples to determine physical properties were taken from the tanned pieces. Microscopical appearances and the physical characteristics of the leather samples after tanning and finishing have been tabulated in the table below :

Histological characteristics of the samples during the staling period.

Staling period 12 hrs.—Epidermal tissue and other structures appear to be normal; no remarkable change in tissue structure is evident excepting the presence of some bacteria in the flesh layer.

Staling period 24 hrs.—Epidermal layer though intact the cellular structures in corium appear to be affected. Hair root remain unaffected. Sweat glands collapsed and their cellular lin-

ings are partly effected. Sebaceous glands appear to be slightly affected. Bacterial penetration throughout the thickness of the skin is evident and a dense accumulation of bacteria is present in the grain layer.

Staling period 36 hrs.—Epidermal layer completely loosened; cellular structures present both in grain and corium are completely destroyed. Hair root sheaths disappeared, only a few isolated basal cells are present near the hair bulb. Cellular linings of sweat glands completely disappeared. Sebaceous glands are affected and sac walls ruptured, fat cells appear as granular mass showing less affinity for the specific stain. Erector-pilimuscles degenerated. Grain surface in some places collapsed and appear hazy. In corium, fibre bundles appear yellowish in colour. Elastin net work in grain layer remain unaffected.

Staling period 48 hrs.—No cellular structure throughout the thickness is present. Grain layer completely damaged. Erector-pili-muscles appear thinner. Elastin net work appears to be affected and less dense in structure than in 36 hours staled piece. Collagen fibre bundles of corium appear more yellowish in colour, more split up into fibres and rather looser in weave. Angulation of fibre bundles falls. Reticulin net work appears less dense.

Staling period 60 hrs.—Elastin net work is more affected. Collagen fibre bundles further degraded and appear more split up than after 48 hours. Fibre bundles appear flat and loosely woven. Reticulin net work appears less dense and in stretched condition.

Staling period 72 hrs.—The amount of elastin appears to be reduced by 80%. Individual distinctness of fibre bundles of corium gone down and appears to be glued; and the structure is loose and empty. Reticulin net-work remains as before.

Microstructure and physical properties of the leather samples

Staling period.	Outward appearance and feel of the leather.	Fibre structure.	Total thickness of leather.	Shrinkage temperature.	Tensile strength (lbs./sq. inch.)	Tearing strength (lbs./mm. thickness)
Control p.c.	Full, tight and smooth grain.	Ordered weave, full fibre bundles, more than medium amount of splitting, angle below 45°, fairly good merging.	2.76 mm.	101°C.	6222	10.9
12 Hours ...	Full, tight and smooth grain.	Ordered weave, full fibre bundles, more than medium amount of splitting, angle below 450, fairly good merging.	2.78 mm.	101°C.	6229	10.9
24 Hours ...	Full but grain slightly loose and pipy.	Disordered, slightly thin fibre bundles, slightly loose weave, angle below 30°, poor merging and connecting fibres damaged.	2.68 mm.	101°C.	5676	10.9
36 Hours ...	Not full rather empty and grain damaged.	Disordered, thin and short bundles, loose weave and poor merging.	1.98 mm.	100°C.	4337	7.2
48 Hours ...	Thin, Soft and grain partly damaged.	Disordered, thin and short bundles, more split up than in 36 hours.	1.96 mm.	96°C.	4330	7.0
60 Hours ...	Thin, Soft and spongy entire grain surface damaged.	Very disordered, thin and short bundles, loose weave, medium amount of splitting.	1.50 mm.	91°C.	3322	6.6
72 Hours ...	Very thin, soft, spongy entire, grain surface and part of corium damaged.	Very disordered, thin and short bundles, very loose, and less than medium amount of splitting.	1.36 mm.	90°C.	2885	6.5

Conclusion :

It will be evident from the above results that the postmortem changes in the tissues (especially cellular components) of uncured skin set in and heavy bacterial accumulation takes place in the grain layer after 24 hours of the death of the animal when the skin is kept at a temperature between 28° and 31°C. Although the collagenous tissue in corium is degenerated considerably only after 36 hours, the fine fibres connecting grain and corium are damaged as early as after the staling period of 24 hours and the tensile strength of leather also is considerably decreased after this period. It will also be seen from the tables that both histological characteristics and some of the physical properties namely, merging of the grain fibers into corium, microstructure of corium, total thickness, and tensile strength of leathers made from uncured pieces after 24 hours staling are much lower than those of the leathers made from fresh and 12 hours staled pieces. The overall leather forming quality falls considerably from the staling period of 24 hours onward. The above results therefore indicate that proper curing of the skin is essential immediately after the death of the animal and in any case not later than 12 hours. If the uncured hides and skins are kept without proper washing and cleaning beyond this period the tissues are likely to be affected lowering the value of finished leather.

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A note on the damage caused to the skin of cattle, buffaloes, sheep and goats by parasites.

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Members belonging to the Phylum Arthropoda play a prominent role in affecting the condition of the skin of animals especially cattle, buffaloes, sheep and goats. Though arthropods form the bulk, some helminths and protozoa also play a part in the causation of such damage.

The following are some of the important parasites of livestock which have a direct bearing on the quality of the skin. Arthropods live on the tissues or blood of the animals. Besides their role as transmitters of protozoa, rickettsial, helminthic, bacterial and viral diseases of animals, majority of them during their adult phase or larval stage

feed on the blood and fluids of the hosts by piercing the skin or feed on the scales and debris, thereby causing injury to the skin. Either by their bites or by their movements on the skin these ectoparasites cause a lot of irritation and annoyance. Animals bite and scratch the portions leading to inflammatory reactions resulting in the formation of vesicles. Bacterial contamination of such portions will result in pustule formation which ultimately form ulcers. During the attack by some flies, animals get terror-stricken, run frantically and receive injuries.

Cutaneous myiasis caused by blow flies such as **Chrysomia bezziana**, **Calliphora erythrocephala** and **Lucilia cuprina** is of considerable importance for the skin and hide industry. Besides the larvi of those flies, those of **Sarcophaga ruficornis** (Flesh fly) also play a part in the causation of cutaneous myiasis. The larvae thrive generally in the open wounds caused by operations or accidents. Strike is also initiated sometimes on the intact skin of sheep covered by soiled wool and dirt. This type of strike is generally by primary blow flies like **Lucilia** and **Calliphora**, while the larvae of **Sarcophaga** and eggs of **Chrysomia** are laid on open wounds only. The maggots penetrate into the wounds and make deep tunnels. Such maggot infested wounds, discharging foul smelling exudate are very common in our country. In Madras, **Crysomia bezziana** (Blue green bottle) is the fly concerned with fly blown wounds.

Very serious loss is caused by the warble flies. The mature larvae of **Hypoderma lineata** in cattle and **H. Crossi** in goats and sheep make their way out through holes made in the skin and thus damage the skin by making perforations. The loss by this infestation alone to our country was calculated as Rs. 2 crores. Fortunately, Madras is free from these flies.

In countries like Australia, the effects of infestation by the buffalo fly—**Lypersia exigua** among cattle, have been studied extensively, but no such information is available in our country even though **L. exigua** and **L. minuta** are present here. These biting flies almost remain on their host for several days. To relieve the constant irritation caused by thousands of flies, cattle and buffaloes rub the affected areas vigorously against any hard object causing thereby raw areas and extensive wounds on the skin.

The biting flies such as **Simulium indicum** (buffalo fly), **Simulium striatum**, various species of **Tabanus** (horse-fly), **Stomoxys calcitrans** (stable fly), **Philaematomyia insignis**, **P. gurnea** and **P. lineata** common in our country, cause irritating injury to the skin with their powerful biting mouth parts. Cattle, sheep and goats become terror-stricken at the approach of the bot flies (**Hypoderma lineata**, in cattle, **H. Crossi** and **Oestrus ovis** in sheep and goats) and receive wounds and bruises during their stampede.

The commonly found like **Haemotopinus eurysternus** and **Linognathus vituli** in cattle, **H. tuberculatus** in buffaloes and **Bovicola ovis** and **B. caprae** in sheep and goats cause lot of irritation leading to scratching, rubbing and biting which produce wounds and bruises. Besides loss of hair, skin becomes dry and scaly with the formation of scabs and crusts giving the appearance of mange.

The flea (*Ctenocephalus felis*) also causes a similar damage to skin just like the louse.

Tick bites also damage the skin. Skin completely beset with hard ticks like *Hyalomma aegyptium*, *Boophilus annulatus* and *Haemophysalis bispinosa* is a common sight in our livestock. The tick bite marks in the skin considerably lessens its value.

Mange in the domestic stock is of considerable importance. The mites live in the skin thriving on the lymph and epidermal scales. *Sarcoptes scabiei* and species of *Pseroptes* (*P. bovis*, *P. ovis*, *P. caprae*) cause considerable irritation and itching resulting in the formation of vesicles. The biting and rubbing increase the inflammatory reactions. The exuding lymph and serum coagulate and form scabs. Hairs fall out and skin thickens and becomes wrinkled covered by epidermal scales and crusts. Such diseased areas spread considerably and the whole appearance of the skin is altered. Similar damage can also be caused by species of *Chorioptes*.

Species of follicular mange mites (*Demodex bovis*, *D. ovis* and *D. caprae*) enter hair follicles and sebaceous glands and cause inflammatory reactions resulting in thickening and wrinkling of skin with loss of hair. This type of scaly form of the disease gives rise in some cases to pustular lesions due to bacterial invasion. Both the forms occur in bovines ; the scaly form in sheep, while in the goat pustules only are seen.

The mite *Pseregates ovis* and the larval form of velvet *Trombicula sarcina* are said to cause considerable injury to the skin resembling mange in Australian sheep, but the same have not been observed here even though the larval form of the velvet mite. *T. delinensis* affects the domestic animals and man in our country.

Of the helminthic infections *Stephanofilaria assamensis* a filarid worm causing the disease commonly known as 'hump sore' in cattle is important. Though this worm does not occur in Madras, it is prevalent in Assam, Bengal, Bihar and Orissa and a large percentage (90%) of cattle in Assam is said to suffer (Pande 1935). The verminous dermatitis appears in the form of multiple appules which coalesce by the rubbing of animals due to pruritis. Scabs and crusts are formed. Hairs fall out. Skin becomes thickened. Repeated acts of rubbing on hard objects make the lesions ulcerative with the destruction of epithelial cells, hair follicles and sebaceous glands. Granulation tissues are formed. The lesion first appearing round about the region of the hump spreads.

Microfilariae can also cause skin lesions in cattle. Nodular eruptions and corrugations of skin resembling mange have been found to be caused by unsheathed microfilariae (Srivatsava 1939, Rao 1943).

Lesions in cattle described as Bursati, Dum-Dum sore or Calcutta shore revealed on histopathological examinations of skin tissues sections of nematodes which may be only *Stephanofilaria assamensis* (Dutt 1957).

Parafilaria bovicola causes pin point haemorrhagic nodules in cattle in the skin which bleed suddenly. This condition which is common in our country will tell upon the value of the skin.

Subcutaneous nodules in bovines caused by worm nests of **Onchocerca gibsoni** make the skin thickened due to infiltration of the microfilariae in the lymph spaces.

Infective larvae of **Strongyloides papillosus** and the hook worms such as **Bunostomum trigonocephalum**, **B. phlebotomum** which enter the body through penetration of the skin facilitate bacterial contamination besides causing irritation and inflammation. The sequence will be the causation of skin disease especially in the legs which may extend upwards.

Dracunculus medinensis, the notorious guinea-worm of human beings can infect cattle also, the females of which gain exit through abscesses and ulcers on the body. The bladder worm **Coenurus gaigeri** lying underneath the skin of sheep and goats will definitely weaken the overlying portions of the skin.

Fasciolasis, Monieziasis, Ancylostomiasis and Haemonchosis not only cause emaciation but also makes the skin rough and dry.

A few of the protozoan infections are found to affect the skin of cattle. A single case of cutaneous leishmaniasis in a bullock has been recorded in Assam. Developing forms of Trypanosomes most probably **T. theileri** were found in the skin lesion in cattle (Rao 1943). The lesions developed as circumscribed thickening of the skin or nodules and the skin became denuded of hair and developed into raw sore since the animals rubbed their bodies on hard objects on account of itching.

Globidium besnoiti affecting the skin of cattle causing damage, has not been recorded in this country although the intestinal form was described under the name of *G. fusiformis* (Hassan 1935).

Of the fungoid diseases affecting the skin, **Trichophyton sp.** comes foremost in cattle. It also affects sheep and goats. **Mircorporon sp.** have been observed affecting sheep and goats. The infection causes itching and inflammation of the skin with the resultant changes in its appearance. Hairs fall off, since their roots become brittle. Nodules or vesicles can be seen which break to form crusts and scabs. The lesion appears in characteristic ring forms. Species of **Aspergillus** have also been recovered from skin lesions of cattle.

The treatment and control measures will vary depending upon the kind of infection tackled.

In general the control of arthropods consists of protecting and treating the animals as well as reducing the number of arthropods. Efficient animal husbandry practice such as hygienic maintenance of animal sheds, elimination of breeding areas of insects and pasture management will go a long way in the control. Application of insecticides especially the chlorinated hydrocarbons like D.D.T. and B.H.C. which have a residual effect is very important in both the control and treatment aspects. The insecticides as sprays should be used in the breeding

ground to cut off the life cycle of arthropods. On the animals they should be used as dusts or sprayed or incorporated in dips as a treatment as well as for control. The Animal Husbandry Department should make the ryots familiar with dips and full advantage can be derived if we can construct dips in villages so that they can dip their livestock periodically. This procedure will go a long way in safeguarding our livestock against arthropod borne diseases, besides preserving the value of skin and hides. Biological control of insects and arachnids are still in the experimental stage.

Drugging with appropriate medicines, proper disposal of manure, avoidance of infected pastures, control of intermediate hosts if any and letting out animals for grazing after the disappearance of dew drops from grass are important measures against helminthic infections.

Treatment against protozoan infections and treatment and isolation of cases with fungoid diseases are important. I hope the above note clearly illustrates the role of the veterinarian in the national task of preserving the value of domestic stock not only while they are alive also but after their death. Hence, our work in that sphere and the activities of this National Institute are closely linked.

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Defects in Raw Hides and Skins and Suggestions for improvement.

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There are many defects in the raw hides and skins which reduce their value to a greater or lesser extent. Many of these defects could be avoided by careful feeding and management of the animals while others could be avoided by taking proper precautions at the slaughter houses and in the skin ware-houses. The defects in flaying, curing and preservation are as important as persons while due to improper management of stock. Dirty conditions, insect bites, tears, bruises scars, brand marks, flaying cuts of marks improper curing, Moth and brethle infestation, damage by rat bites and imperfect packing are some of the defects. It may be estimated that there is an average reduction in their value by about As. 4 for every piece of hides and skins produced in India. This involves an approximate loss of about 1,42,5000 for 57 million pieces produced in India. Thus, if we can try and avoid the above defects—almost all of them are avoidable. It would be possible for the millions of farmers, tanners, and traders, to increase their returns by about 1½ crores of rupees.

The various defects mentioned above will fall under two main (i.e., defects that occur during management before the animals die or are slaughtered and those that occur after death during the flaying and curing.

Management defects:

Bruises, scars and tears usually occur due to careless management of the stock. Bruises and tears may occur if the animals are beaten or pierced with sharp instruments etc., or when the animals are dragged on the ground just before slaughtering. These could be easily avoided by kind treatment of the animals and Animal Husbandry Department can assist in doing propaganda about these aspects. When these animals are driven for grazing through forests having a thick growth and low level bushes their bodies will be sometimes scratched by the thorns and tears and pieced wounds are likely to occur. These could be avoided by proper management of the grazing areas such as thinning and pruning the bushes to afford clear moving space for animals, by cleaning the under growth of bushes in the forest so that the pasture grasses can grow well without affecting timber production, etc., For this purpose it is advantageous to modify the forest policies whenever necessary and to develop the marginal forests to suit the livestock needs apart from the fuel requirements of the area. Incidentally this facility will improve the condition of the stock and the quality of hides and skins also. The State forest departments can assist greatly in this matter. Brand marks will not seriously affect the quality of the hides and skins if they are marked on the extremities instead of high up. Housing the stock in sanitary and hygienic conditions will prevent the hides and skins from becoming soiled or dirty.

Insect bites through ticks, lice etc., cause the worst damage to the quality of the hides and skins. These insects cut through the grain of the skins thus breaking the continuity of the strands and reducing the strength of the leather. The insects also weaken the animal by sucking blood and in many cases cause diseases also. This indirectly makes the skin lose the condition and the suppleness which is a most important characteristic of leather. Such animals will be hide-bound the skins of such animals will become stiff and will be quite useless.

Worm infestation in animals is another cause for the loss of condition or suppleness in the skins. Animals with heavy worm burden will be anaemic and hide bound and ultimately die in miserable condition, the bloom or the gloss will be graded low even if they are not put under rejects. Thus the direct and indirect damage to hides and skins due to external and internal parasites is enormous. This is more pronounced in case of skins since the sheep and goats are mostly pasture animals exposing themselves to a greater extent to these parasites. Systematic deticking and delousing and deworming of livestock would facilitate the improvement of general condition of stock and production of hides and skins without defects. General Propaganda and demonstration of deworming and deticking in sheep and goats are being carried out in Ex-Andhra State area of Andhra Pradesh to some extent. But it is necessary to adopt this on country wide basis and in intensive manner. Educational films and mobile propaganda units giving the film show at weekly shandies and in groups of villages would go a long way in the matter besides ocular demonstrations of deworming and deticking.

The Central Government and the leather industry can assist the state Governments in financing for such units to be managed by their Animal Husbandry Departments. Subsidised sale of such deworming and deticking agents would popularise their use besides helping the farmers. The Animal Husbandry Department in Andhra Pradesh State may require about 3 such propaganda vans with necessary equipment etc. immediately for the purpose. The costs involved for the propaganda vans and subsidised sales of the deworming and deticking agents may not be much when compared with the benefits and increased returns that accrue to the farmers and the traders.

Defects occurring after death:

Bruises and tears occur when the carcasses are carelessly dragged on ground after death or slaughter and they could be avoided by lifting the carcasses. Observance of cleanliness in slaughterhouses are essential for production of good hides and skin. Flaying is a very skilled job and the appointment of trained flaying assistants at each slaughter house would facilitate proper flaying avoiding the cuts.

Opening up of the skins must be done along the correct lines in order to get a nice square skin giving the maximum leather surface. The knife should be used only for opening up and around the points and the fist for the rest of the operation. The skin should be removed immediately the blood ceases to flow from the veins, since it comes off more easily while the blood heat is still present. Care should be used in using knife in the case of fat tailed sheep as fistling is difficult in these. The adhering fat in such cases can be removed after the skin has been salted and rolled for 24 hours. It will be advisable to train as many slaughtermen as possible in each place on the scientific methods of flaying and care of skins. Care of the skin after flaying is another important aspect in the leather grade. The most satisfactory method of curing skins is by strewing common salt over the surface of the wet skins. The salt is drawn by the moisture in the pores of the cells of the skin and penetrates easily; it acts as a mild antiseptic and inhibits the activity of the putrefactive bacteria. It should be applied after body heat is cooled off (i.e.) about 20 minutes after flaying and after the fibre of the skin is dehydrated and through penetration should be ensured. About 10% of the weight of the skin would be quantity of salt required. The quality of the salt is also important since the impurities cause damage and have adverse effects on the skins.

The drying and storing are to be done carefully as otherwise the contraction will be defective and the moths and beetle will damage the skins. What is called the sweating of the skins should be avoided and also the damage by rats should be avoided.

Parasitic skin diseases of animals and their effects

(Review)

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The live animal is subjected to various skin diseases, mostly of parasitic origin which are responsible for different kinds of defects in the finished leather. Most of these defects have far-reaching effects

to the Hide merchants and tanners, as they prove very costly to them, in view of the economic loss sustained. Quite a number of skin affections have been recorded from animal skins in our country and the type of defect they produce in the finished leather are also known. A review of the different kinds of skin diseases affecting the live animals and the damages they cause in the finished leather are presented here. The common kinds of skin damages could be classed as Mange, Tick, Louse, Warble, Fungoid and Nematode damage.

Mange or acariases:

The common types of mange occurring in animals are Sarcoptic, Psoroptic and Demodectic mange. They are caused by minute mange 'mites' or 'acari'.

Demodectic mange or follicular mange:

This is caused by the mite *Demodex folliculorum*, and has been recorded from cattle and goats in India¹. This is an affection of the hair follicle and is seen as small nodules in the skin of cattle. These nodules contain a cheesy fluid, filled with a large number of these mites. These nodules when they burst, produce breaks in the grain surface². In some case, these pus pockets may even separate the grain layer from the flesh². O'Flaherty and Roddy³ after a detailed study of this condition in cattle hides, concluded that the damage may extend from simple darkening of the grain, to damaged grain, and the corium may also be affected in some badly affected cases. In goat skin leather, the *Demodex* lesions appeared like blisters on the grain surface, while the flesh side revealed penetrating depressions.⁴

Sarcoptic mange:

Caused by the mite *Sarcoptes scabiei* (Fig. II) is known to occur in cattle, sheep, goats and horses. This parasite burrows into the skin forming tunnels, resulting in intense irritation. The animal scratches itself against other objects, which adds to the damage already in progress. The affected areas become thickened, forming many folds. In neglected cases, extensive areas may become affected. The grain in such cases shows thickening and fibrosis with scale formation^{2,5} while in goat skin leather, the grain was badly disfigured⁴.

Psoroptic mange:

The effects of this disease are more or less similar to those produced by the previous one, but the mange mites in this case are more specific to their host. In Psoroptic mange or 'sheep scab' the formation of hard incrustations results in a badly damaged grain in the sheep skins⁶.

All the above mentioned parasites are very small and can be recognised only with the aid of the microscope.

Tick marks:

Ticks are much larger insects and can be seen by the naked eye. They cause small depressions in the grain surface, at the places of attachment^{2,7}. Tic damage is represented by depressed scars in the grain

surface and is confined to the superficial layers of the leather. Such scars are seen in cattle hides, sheep and goat skins⁶. This accounts for considerable lowering in the value of grained leather.

Louse damage:

Only inferior grades of leather could be made from lice infested hides and skins, as these were scarred in the grain surface, and some loose decomposing spots were also said to be produced in them⁶.

Warble holes:

These are seen as small holes, particularly in the back portion of the cattle hide and is also seen in goat skins. The common species of warbles occurring in India are *Hypoderma lineatum* and *Hypoderma crossi*^{9,10,6}. The former occurs in cattle while the latter affects goats and sheep. The larvae in the course of their life cycle settle down under the skin, forming tumours. They make small holes in the skin, for them to breathe the external air¹⁰. Thus, holes are produced in the animal's skin, which lower its market value depending upon the number of such holes in each hide or skin. Any number from 6 to 700 warble holes may be present in a single cow hide⁸.

A certain amount of confusion appears to exist between our hide and skins dealers and the foreign buyers, regarding the use of the word, 'POCCA' for warble holes in hides and skins. The term, 'POCCA' refers to warble holes in the Vernacular. While this is so, Tick marks are also designated as 'POCCA' by some, which gives rise to confusion. From the description given earlier, it will be seen that tick marks are superficial depressions in the grain surface, while warble holes extend from the grain to the flesh. This confusion can be avoided by adopting the English equivalents for the same.

FUNGAL DISEASES

Ringworm:

This is a general term used for some skin conditions in animal skins, caused by fungi. Fungi of the genus *Trichophyton*, *Microsporon* and *Achorion*¹¹ are known to affect all the species of animals, particularly calf skins in addition to man. These fungi have also been recorded from cured hides and skins^{12,13}. The penetration of the hair follicles by these fungi leads to intense itching associated with exudation of lymph and proliferation of epithelial cells. The hairs become brittle and fall away. The infection gradually spreads in concentric circles. This condition of the skin has been shown to produce circular patches in the grain of the leather produced². Stuart¹⁴ states that such leather is porous and the damage may even extend to the corium. Skins of animals recovered from this disease are believed to be free of these scars². Hence proper treatment to affected animals would be of much help in producing healthy calf skins.

Nematode damage to hides:

It has been shown that a nematode skin affection caused by *Stephanofilaria stilesi* has been responsible for the production of holes in the belly portion of American cattle hides¹⁵. A similar condition

exists in North Indian cattle¹⁶, the condition being called as 'Hump-sore'. The causative agent—"Stephenofilaria assamensis" has been shown to occur below the rete malphigi layer of the skin. The actual loss to hides produced by this kind of damage to Indian Hide Industry is not known.

It will be seen from the information presented that quite a variety of damages are caused to Hides and Skins by animal parasites. The prevention of such damage, therefore, rests entirely with the live-stock owner, who perhaps is not aware of the leather-making qualities of his animals skin. Quite an amount of loss sustained by the hides and skins industry could be reduced by rendering timely treatment to animals suffering from skin diseases.

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Viral, bacterial and other diseases causing damage to live hides and skins

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Many diseases of animals, both specific and non-specific, cause varying degrees of damage to the skin and thereby enormous loss is sustained by the country. We do not know how far the authorities in leather industry are aware of the situation in regard to this. It may be emphasised here that any effort made towards the prevention of them has a direct bearing on the leather industry as a whole and in this con-

nection it is well to remember that some of these diseases are preventable through application of recent knowledge on control of animal diseases.

When we talk of animal diseases which affect skin, it seems necessary to draw a distinction between diseases that have only a remote or indirect effect on skin structure and those that cause definite lesion on them. In this short note, reference is made only to the latter group of animal ailments. They include Pox diseases, sheep and goat dermatitis, skin lesions of Rinderpest, caseous lymphadenitis, Bovine lymphangitis, yoke galls and suppurating lesions of the skin and skin tumours.

1. Pox disease:

This is a viral infection which shows a predilection for skin and is responsible for heavy mortality in sheep in this country. It runs a rapid course in the flock and mortality through respiratory involvement is assessed to be nearly 50% in any outbreak. The skin lesions appear as Papules which in course of few days become vesicles. These are converted into pustules over which scabs are formed. Healing takes place under the scab or crusts and are eventually cast off leaving a scar. The depth of the scar depends on whether the destructive process has reached the cutis vera or not. In sheep the skin being thin compared with that in other domestic animals, the inflammatory reaction invariably reaches the corium and hence in this species the scarring is severe. This naturally reduces the value of the skin very much in the recovered animals.

Pox diseases in other domestic animals like cattle, buffaloes and goats are also prevalent in this country. But they are comparatively of a benign nature and hence the ultimate damage to skin is not so great as in the sheep.

2. Sheep and goat dermatitis:

This specific disease in sheep and goats is caused by a virus which is immunologically different from the pox viruses. For a long time, it has been confused with pox and taken as a typical form of pox in these species. However, cross immunity studies done at Mukteswar showed that the two conditions were caused by separate viruses. (Ind. J. Vet. Sci. and Animal Husb. 1946, Vol. 16). The skin lesions are in the nature of discrete nodules of 4-12 mms. diameter and raised to about 1-2 mm. above the surface. Within 7-10 days, the nodules undergo necrosis and shed leaving areas with clear cut punched out rims. In cases that survive, the ulcers dry up forming scabs which are firmly adherent to the underlying tissue. Histologically the lesions show besides proliferative and necrotic changes in the epidermis, several inflammatory reaction with mono-nuclear and plasma cells infiltration and extensive extravasation in the corium and sub cutis. This means the resulting scars are very deep and the skin would be practically useless.

3. Rinderpest "Skin lesion"

In Rinderpest the well known lesion is the nature of diphtheritic inflammation of the alimentary tract. However in an outbreak occasional cases which show rough coat and extensive dermatitis, are reported. There are often mild cases of the disease and survive the outbreak.

Possibly these skin lesions are caused by inter-current infection by fungi and it has been suggested by some workers that the lesion may be in the nature of cutaneous streptotricosis.

4. Caseous lymphadenitis:

This is essentially a disease of sheep caused by *Corynebacterium ovis*, the chief lesion being chronic inflammation of superficial lymph nodes with extensive areas of caseation. Though apparently the importance of this disease is not recognised in India, many cases of this condition could be detected in sheep coming for slaughter. The importance of this disease in leather trade is that many of the affected may discharge the caseous material outside with resulting damage to the skin.

5. Bovine lymphangitis:

This is a chronic disease in bovines caused by a bacterium called *Pasterurella psendotuberculosis redontium (type III)*. The disease is of common occurrence in this part of the country. Though the primary lesion is located in the superficial lymph nodes and the vessels in the vicinity, invariably after surgical intervention spontaneous rupture of the abscesses, the skin around is badly damaged.

6. Yoke-galls and suppurating lesions of the skin:

Injury to the yoke region in bullocks very often ends in severe inflammatory oedema and in due course organisation of the exudate at the site. This often requires surgical interference and subsequently healing of the wound by second intention results in deep scars at the site.

Suppurating lesions in the nature of abscesses are of frequent occurrence in domestic animals. These naturally heal by way of granulation tissue formation only with scar formation later. The damage thus caused to the skin in and around the lesion is obvious.

Skin tumours:

Among the domestic animals whose skin are made use of in leather industry bovines show a high incidence of skin tumours. Sheep and goats being killed at a fairly young age, rarely suffer from this condition. In a recent survey it was found that altogether 491 skin tumours were encountered among the total of 2003 connective tissues tumours diagnosed in the Pathology Department of this College. This included 133 fibromas, 132 papillomas, 62 epidermoid carcinomas, 111 melanomas, 11 fibro carcinomas and 15 lymphosarcomas. Naturally these skin lesions after excision and healing affect the economic value of the skin. Besides, in respect of malignant tumours there is danger to the animals' life from metastasis into internal organs.

Summary

Attention has been drawn to the importance of animal diseases in leather trade and industry. Among the specific and non-specific diseases that cause damage to skin of animals a distinction has been drawn between those that indirectly affect the value of skin structures and those that produce distinct lesion in the skin. In this note reference is made merely to the latter type of diseases. Those included are pox diseases, sheep and goat dermatitis, Rinderpest "skin lesions", caseous lymphadenitis, Bovine lymphangitis suppurative lesions of skin and "Yoke galls" and skin tumours. A short note with particular reference to injury caused to skin is given with respect to each of these diseases.

Certain parasitic infections of cattle involving the skin

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It is perhaps not generally known to the Leather Trade that there are animal agents, other than flies, ticks and mites, which damage the skin of cattle in India. Certain nematodes (round worms) among the helminth invade the skin of the living bovine, in the adult or larval state, and prevoke such injury as may reduce the quality of the hide. Mention may be made of the three most important ones.

1. *Parafilaria bovicola*:

Sexually mature worms reside in the subcutaneous and intramuscular connective tissue, and cause large nodules in the skin. These grow to a size of 40 mm. \times 10 mm., and are prominent in the warm months of the year. Owing to the migration of the adult worms, bleeding occurs in the subcutaneous region. Hence these are commonly known as "Summer sores". These nodules frequently rupture too, but disappears in the cold weather. They are distributed on the sides of the neck, the withers and the trunk. When the bleeding stops, the blood dries up to form dark crusts, and the wound heals gradually. Secondary infection of these wounds may result in abscess formation. The hides are conspicuously disfigured and damaged by the perforations.

The infection is fairly widespread in several parts of India, and occurs in the Philippine Islands too.

2. *Stephanofilaria assamensis*:

Skin lesions in cattle are caused by this filarial worm, and go by the name of "Dum-Dum Sore" or "Hump-Sore", in the North-Eastern States of India, viz., Bihar, Assam, Bengal and Orissa. The dermatitis manifests itself initially as a thickening and wrinkling of the dry skin; later, pustules 1 to 10 mm. in diameter, containing adult and larval worms, appear. Dopilation also ensues invariably. The larger lesions exude serum and blood which form crusts in a short time. Actively spreading lesions show numerous bloodspots around a thickened and wrinkled hairless area, but a smooth hairless patch indicates that healing has commenced. The skin eventually appears to lose its normal texture, and its value is therefore appreciably lowered.

3. *Onchocerca gibsoni* and *O indica*:

Give rise to nodule formation in the subcutaneous tissues of the brisket and hindlims. These nodules serve as worm-nests in the connective tissue of cattle in several countries including India and Ceylon, and adult worms discharge their larvae into the blood. These eruptions are capable of leaving behind scars that will affect the quality of the hide.

Microfilarial dermatitis in bovines has once been reported from North India by Srivastava (1938) and it is possible that several other less important helminthic infections involving skin lesions are yet to be detected.

Future work in Leather Technology should therefore visualize a survey of the various etiological factors that contribute to the damage suffered by raw hides and skins, and a microscopical investigation of the morbid changes resultant to parasitic infection, notably verminous dermatitis. Curing and preservation of the hide would depend to a great extent on such studies.

Some defects in raw hides and skins and suggestions for improvement

By

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Abstract: Estimated annual production of raw hides and skins in India is valued at approximately Rs. 50 crores. Nearly one-tenth of this value is depreciated as a result of damage caused by biological factors such as warble-flies, ticks and beetles. Researches are in progress to reduce the incidence of infestation and thus improve the quality of hides and skins produced in the country.

Warble-flies, which are mostly prevalent in dry and arid tracts of the country, could be controlled by dressing and preventive methods. Derris powder in aqueous solution as a dressing on the warble tumours and singeing for the destruction of warble-fly eggs as a preventive method, in their respective seasons, have proved adequately effective for the control of these pests.

Ticks which cause blemishes on the grain-side of the hide or skin could be eliminated either by the application of certain chemical drugs such as DDT, Gammexane etc. or through the propagation of a parasite (*Hunterellus hookeri*), technically known as biological control of ticks.

The "hide beetle" which is known to be a serious menace to the industry in the storage of raw hides and skins, could be controlled by the improvement of store-houses and through dusting of Gammexane powder on the flesh-side of the cured hides and skins.

According to the present market rate the estimated value of hides and skins produced annually in India will not be less than Rs. 50 crores. It has been further computed that this raw stock is depreciated to the extent of not less than one-tenth of its value as a result of damage caused to it by warble-flies alone, the ox warble-fly and the goat warble-fly. Although the monetary value of the loss resulting from the damage

caused by ticks and the "Hide beetle" has not been estimated but considering the extent of depreciation suffered on the market value of each hide or skin affected, the financial drain must be enormous.

In view of the economic nature of the problem and the continuous loss of national wealth, the Government of India undertook to finance an investigation into the life-history and bionomic and later, into the question of suitable measures for the control of these pests. As will be seen from the results of this investigation summarised below, a decisive advance has now been made towards the control of the pests mentioned above. Detailed accounts of this work have appeared from time to time in the *Journal* and *Reports* of the Government.

Warble-fly

Damage to hides and skins:

Nearly every farmer in Europe and America knows that the warble-fly is a cause of serious damage to hides and goat skins, but in India where this pest causes greater economic loss than anywhere else in the world, stock-owners and even the majority of hide-merchants, are unaware that the numerous small holes apparent in a large percentage of otherwise good hides and goat skins is the result of infection to the living animal caused by this insect (Illustration : 1)

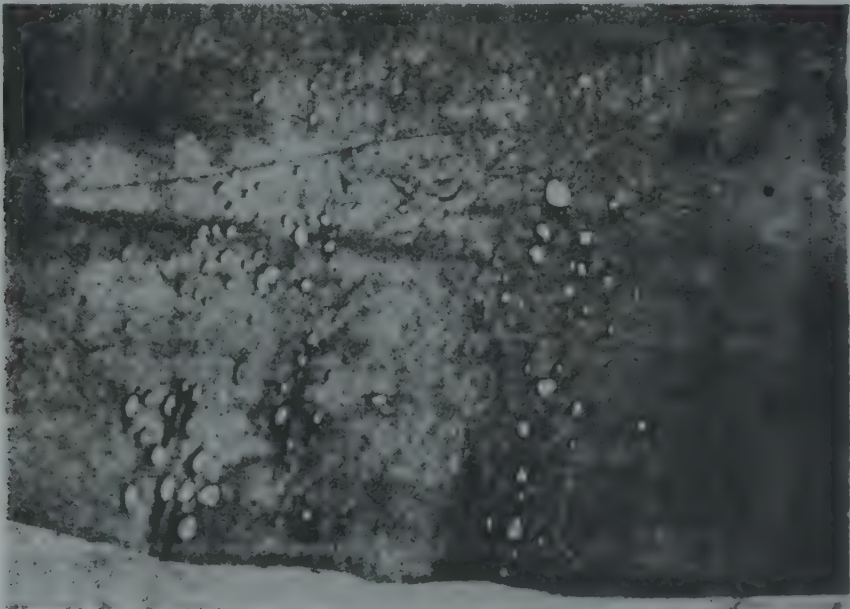


Fig. 1.

A piece of leather showing warble holes.

Loss to livestock:

The Indian farmer who is not interested in the hides and skins of his livestock may perhaps be indifferent to the losses sustained by

his countrymen who deal in hides, but he would feel more concerned were he only to realise that his warble-affected cattle suffer from loss of condition and a diminution of milk yield during such time as the grubs of the fly are lodged just beneath the outer skin of the animal's back (Illustration 2)

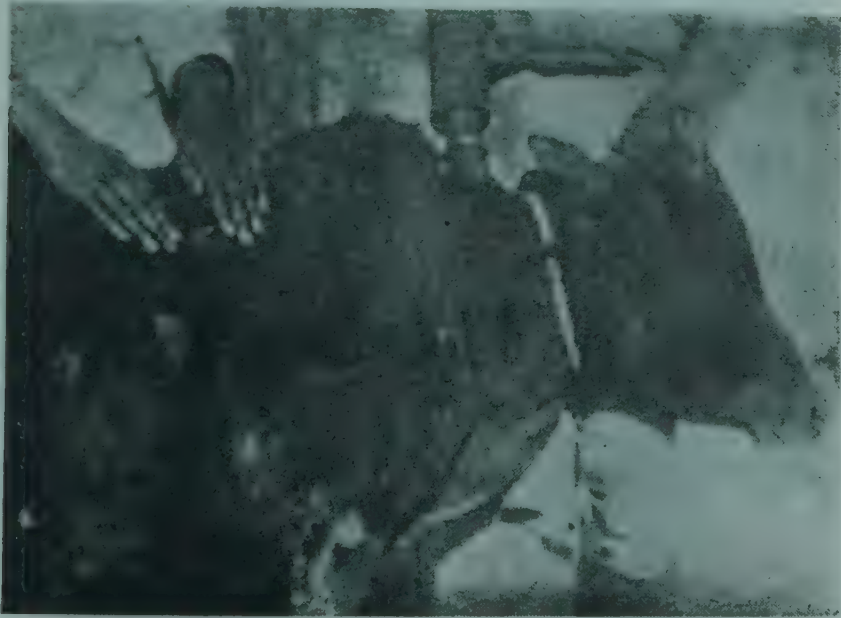


Fig. 2.

A warble grub being squeezed out of an animal's back

Warble-fly control:

The methods for combating warble-flies are: (i) Preventive method and (ii) dressing method.

Preventive method :

In view of the highly localised character of the site of egg-laying, it has been found that periodic singeing of hair on the legs of the cattle, during the egg-laying season (middle of March to middle of June), is the only effective preventive method of destroying the eggs. Between each singeing an interval of 5 to 6 days is recommended.

A simple and inexpensive singeing apparatus suited to Indian conditions has been devised. It consists of a thin iron rod, about 4 feet in length, with a handle at one end and a loop at the other. Through the loop a piece of coarse, old cloth is inserted and wrapped round the rod. The cloth end of the rod is soaked in ordinary mustard and ignited. The flame is put out and the smouldering torch is

gently passed over the legs of the cattle so as to singe the hair (Illustration 3)



Fig. 3.

Singeing the hair on the legs of an infested animal to destroy warble eggs.

Based on practical results, the average cost of singeing per head of cattle per season works out to be annas eleven only. A total of 40 heads of cattle can usually be singed with one pound of mustard oil.

Dressing method:

The application of dressings on the warble tumours is now regarded as the method of choice for combating the warble-fly pest. The dressing operations should commence in early October and last till the end of January with an interval of about one month between each dressing operation.

The following proportion is recommended :—

Derris powder	... 1 part.
Water	... 10 parts.

A piece of coarse cloth or a brush soaked in the solution is rubbed over the entire back of the warble-infested animal (Illustration 4) The cost per head of cattle per season (four dressings) works out at annas twelve only.

One lb. of derris powder should be enough for about 40 heads of cattle showing moderate warble-infestation.



Fig. 4.

Derris solution being rubbed on the back of an infested animal to destroy warble grubs.

Benefits of control :

Efforts at controlling the ravages of warble-fly may be recognised as of considerable economic importance to India. The hide merchant stands to gain financially by the improved quality of the hides and skins he deals in ; while the country as a whole may expect a great increase in revenue, once India is able to compete on equal terms with other hide producing countries. The farmer will not only see the advantages of adopting control measures in the improved condition and milk yield of his animals, but in time, learn that, once he takes proper care of his cattle and goats, even he may take his share of the profits available from the improved hide industry by affecting his own sale of these commodities, to the hide merchant, instead of handing them over gratis to the *chamar*, to dispose of them as he will.

Tick-bitten-hides:

The injury caused to hides by the perforations made in the skin by the maggots of the warble-fly are familiar to some hide-merchants. They are large and local (on the back) and form conspicuous blemishes that at once discount the value of the hide so affected. The smaller but much more numerous perforations made by ticks are less familiar to him because less obvious, but are recognised by purchasers of hides as by no means negligible blemishes, not only because they are punctures

in the hide substance, but by reason of the permanent stains that surround each puncture, which are apparently co-extensive with the area over which inflammation caused by the tick-bite has extended.

The blemishes caused by tick bites are variously described by experts in handling hides :—

“ Abrasion upon the grain of the hide ” (Illustration 5)



Fig. 5.

A piece of raw hide showing tick bites.

“ A break in the grain of the finished leather. (Illustration. 6).



Fig. 6.

A piece of tanned leather showing tick marks.

“ Spotted and make a very poor leather ”.

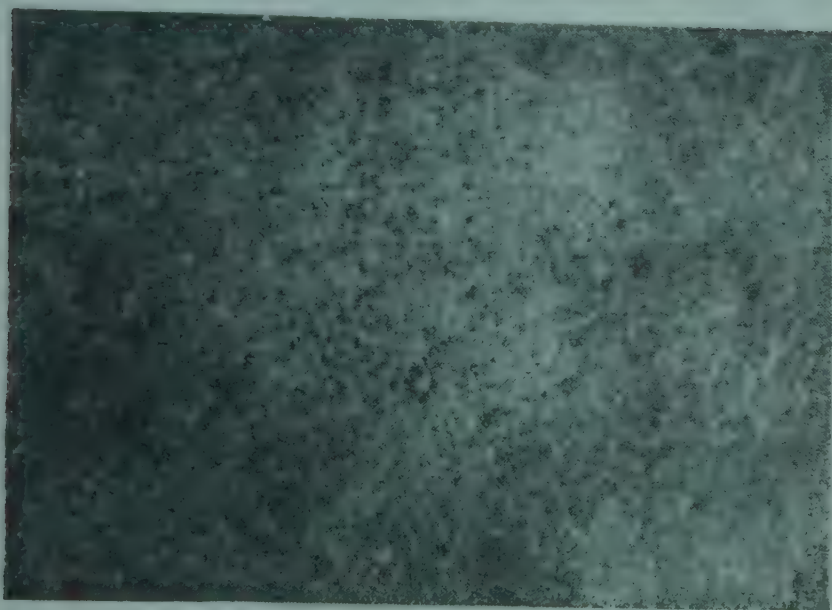


Fig. 7.

Black spots in the leather caused as a result of tick- damage.

Depreciation in raw hides:

In conformity with the fact that the ecological conditions obtaining in India are very favourable to the increase of the tick population, it has been found that in certain villages it is difficult to detect even a single animal as being free from tick infestation. Repeated observation made by tanners and exporters have led them either to reject completely or heavily depreciate in value the raw leather stock raised in certain areas of the country called “ticky” areas. A large proportion of the hides produced in Bengal and Madras are depreciated on this account to the extent of 50 per cent of the price by the Chrome Leather Co., Madras. Similarly, Kanpur tanners have intimated that 50 to 60 per cent depreciation in price is caused by ticks alone to nearly 20 to 30 per cent of the total stock produced in Uttar Pradesh and Punjab.

Tick damage and grained leather:

A large percentage of the Chrome leather now produced in India is finished with the grain left on, so that all imperfections and tick marks on the grain side show very plainly. In olden days the leather for uppers of shoes was made from bark-tanned stick and was buffed and the grain removed. For this leather tanners could use cheap hides that were covered with imperfections and tick marks. The situation today is very different, as there is an increasing demand for grained leather, and for this a large proportion of Indian hides cannot be utilised until the tick is eradicated.

Control of ticks:

During recent years DDT and Gammexane have been brought into use in the field of tick control on account of their non-poisonous properties and superior tickicidal value. Both these drugs have been subjected to a series of trials and have proved highly effective against the common types of cattle ticks occurring in India. It was found that DDT powder, made into an emulsion with Kerosene oil and liquid soap to a concentration of 0.5 to 1.0 per cent, destroyed ticks at all stages within a short time. Further observations had shown that a tick-intested animal treated with DDT had improved its condition to the extent of 50 lbs. gain in weight within a period of ten weeks (Illustration 8)

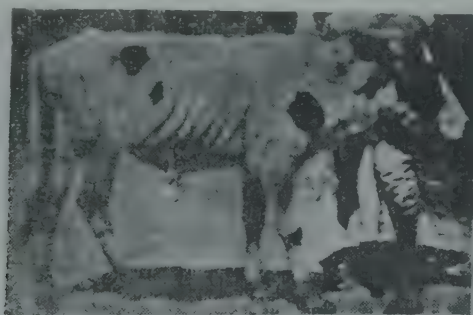


Fig. 8

Effect of D. D. T. application on a tick infested animal.

Hide-beetle

Next to warble-flies and ticks, the most important biological factor causing an enormous financial loss to the hides and skins industry in India is the "Hide beetle". Unlike warble-flies and ticks which affect the hide or the skin during the life-time of the animal, the "hide beetle" causes damage during storage of raw stock. As a result of the inadequacy of transport facilities, a large proportion of the Indian hides and skins are stored in dark and damp godowns, before arrangement could be made for transporting them to the nearest tannery or to a sea port for foreign export.

The incidence and intensity of damage is higher under warm and moist conditions and in "dry-cured" hides and skins than in those which have been preserved under "wet salted" condition. Presumably the salt plays the role of an insecticide and the salted hide substance

is perhaps unpalatable to the insect which as a rule eats into the "Flesh side" of the hide or skin (Illustration 9)



Fig. 9.

A piece of raw skin damaged by the "hide-seedle".

Control measures:

"Prevention is better than cure" is the maxim which applies most appropriately in checking the enormous financial losses caused by the leather beetle to the Industry of hides and skins in India. It is not only the pre-application of certain chemical drugs such as Gammexane and DDT which would act as insecticidal and repellent agents, but measures such as the "wet curing" of raw stock with adequate quantity of common salt, proper aeration and periodic exposure to day light of the hides and skins stored in godowns with cemented floors, would go a long way in checking a large proportion of the financial drain suffered by the industry as a result of the hide beetle attack.

The chemical method of prevention against leather beetle employed generally at present, is known as arsenication or "Poisoning" of the hides and skins in storage. Although the process is known to yield fairly satisfactory results but a certain amount of technical knowledge involved in the preparation and application of the solution and its poisonous properties is a considerable drawback for its adoption in this country.

Comparative tests carried out under laboratory conditions have shown that Gammexane powder at a concentration of 2.5 per cent in talc powder, when dusted to form a thin film on the "flesh side" of hides or skins infested with hide beetle, causes a mortality of 85-90 per cent among beetle larvae and is followed by 30 days as a period of protection from reinfestation by the parasite. A quantity of about 4 ounce of Gammexane powder mixed in talc is considered enough to dust nearly 8 cow or ox hides or about 15 goat or sheep skins.

Cost:

Taking into account the cost of labour involved and the price of muslin bags, through which the powder is dusted, the total expenditure for a consignment of 100 hides or double the number of skins, work out to nearly Rs. 3-4 normally.

In view of its non-toxic properties to man, and easy availability in the form of ready made powder Gammexane may, in due course of time, replace the present method of arsenication or "poisoning" of hides or skins for prevention or control of hide beetle in India.

The impact of Animal diseases on leather manufacture

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(REVIEW)

A knowledge of the significance of the different diseases both bacterial and viral, affecting the living animal, to the leather manufacturer, will be useful in the prevention of possible infection amongst the tannery workers, as well as in the correlation of some defects in leather with those produced by these diseases. This would also help the livestock owner in the production of good hides and skins to supply the leather industry with the proper kinds of raw materials. This is particularly true of Indian hides and skins, as a major proportion of these, i.e. about 75% of cow hides, and a much lesser proportion of skins are from fallen animals, i.e. animals died of disease and other causes¹. In most villages the dead animal is entrusted to the chamar, who in turn tries to make some profit, by selling its flayed skin to the local agent. These ultimately reach the hides and skins merchants, and the tanners. Thus by whatever disease the animal might have died of, its hide or skin is passed on to the tanner, passing through several hands. The skins of such animals carry with them the disease producing germs, and as such act as potential sources of danger to human and animal communities besides causing some of defects in the leather made.

The bacterial and viral diseases of animals, may be considered from three different aspects, by the tanner.

They are:

1. Animal diseases communicable to tannery workers through the agency of hides and skins. Eg. Anthrax.

2. Diseases carried to disease free countries, in which case the products, and effluents from tanneries have to be properly disinfected, Eg. Foot and Mouth Disease.

and 3. Diseases as effecting the value of leather produced.

Of the diseases communicable to man from animals, Anthrax is the one, which is most dangerous to the tannery worker. This

disease is caused by a rod shaped organism, called, " *Bacillus anthracis* ". This organism under certain conditions develops a protective envelope, in which state it is highly resistant to physical and chemical agents. It is in this sporulated or enveloped state it occurs on hides and skins. Tannery workers get this disease by wound contamination. The skin form of this disease is called as " Malignant pustule ". It is also called as ' Wool Sorters disease ' when the disease is contacted by inhaling these organisms, while handling infected hair and wool². The mortal significance of this disease drew the attention of earlier workers, and some methods have been developed to disinfect these hides.

They are:

1. Seymour Jones process³;
2. Schotten froth process⁴.

and 3. The Soda lye process⁵. Robertson⁶ obtained favourable results with fumigation with hydrogen sulphide gas. There is still room for the development of a simple and satisfactory method for disinfecting Anthrax infected hides and skins.

To prevent the introduction of this disease into countries like Newzealand Government regulations required that animal products have to be accompanied by certificate to the effect that these have been tested and found to be free from Anthrax, while in countries like England such materials or disinfected, at the ports of entry³. Hides and skins intended for export to such places can be tested for the presence of Anthrax infection, and the necessary certificates can be issued by a competent authority. It may not be out of way to mentioned that Central Leather Research Institute is getting equipped for such work and would be in the very near future, in a position to issue such certificates of testing under cmpetent authority.

Foot and Mouth disease

Hides of animal died of this disease have to be viewed with special significance, when they have to be exported to countries like America, where this disease has been eradicated by strict control measures. Hide has been shown to be a potent carrier of the virus responsible for this disease and as such has to be disinfected prior to entry in this country⁷.

Effect on the leather made:

It is generally known that leather made from animals died of bacterial and viral diseases are of a poor quality. It has been shown that leather made from hides of cattle died of Rinderpest had very thin fiber structure and a low abrasive strength⁸. This would apply to any bacterial or viral disease of animals accompanied by high fever and debility. Such leathers are usually much thinner and lack substance⁹. While this is the case with generalised systemaic diseases, certain diseases like pox produce damages with a definite mark on leather. In goat kid leather pock marks are seen as circular depressions¹⁰. In addition to the above there are several other diseases present in our country, the significance of which have to be studied from the leather makers point of view. A detailed study of the effect of the various diseases

affecting Indian livestock, and their effects on leather manufacture would be of much help in improving the quality of leather made, which in turn would add to the country's revenue.

ABSTRACT

The significance of the Bacterial and viral diseases of animals to the leather manufacturer is discussed both from the point of view of health hazard to tannery workers, and the quality of leather produced.

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Notes on Raw Hides & Skins from Picker Manufacturers' point of view. PICKERS LIMITED, Ellis-Bridge, Ahmedabad-6.

We are going to preface these remarks by saying that at the present time, only a fraction of the potential value of India's vast production of raw hides and skins is recovered by the producers and there are many reasons for this namely.

(a) The continued folly to regard the production handling, dealing and processing of hides and skins as an "Offensive" industry, to be treated with aversion.

(b) The attraction it holds only for the lowest grade of workers, whose standard and methods of work demand close supervision and care.

(c) The climatic conditions in India are such that they introduce a big element of risk into many undertaking connected with hides and skins.

(d) The religious sentiments and the non-indulgence by our people of carnivorous practices : and the misplaced sanctification of the life of animals.

(e) The lack of sufficient feeding stuffs to support the present animal population.

(f) Lack of adequate and quick transport facilities for the conveyance of hides and skins.

(g) Insufficient attention being paid to the care and breeding of stock.

We feel that points (a) and (d) are beyond our control and power, and constitute a very serious barrier to the proper development of the Industry, which time alone can eradicate. The climate of India makes the observance of higher standards of care, speed, efficiency and cleanliness within the trade more incumbent upon us, and with the judicious use of refrigeration in rail cars abattoirs and factories, losses through ineffective preservation, resulting in putrefaction could be minimized. It is not generally known or appreciated that some of the new chemical preparations which are being offered on the market for the preservation of hides and skins are very effective, also some of the pre-tanning agents which are now available can assist to reduce waste, which is still a predominant and appalling feature of Hide and Skin trade in India.

It is of course well known that we are to a certain extent dependent on the moochi or chamar community for the supply of manual labour for our hide industry, and it would be doing these people a great dis-service if we branded them as unskillful in their work. But unfortunately they cling very much to their old practice and method of work which to-day are out-moded and involve too much waste.

For example any one watching a Chamar flaying the hide cannot but marvel at the speed and skill with which they execute the work, as it is done at present, with the beast and the flayer sprawled on, the ground. But how much better and easier the work can be done if the beast is hoisted up with its hind legs into the air and with the flayer standing with his feet on the ground he can remove the skin without inflicting any damage in the form of cuts or flaymarks; and the skin is drawn off from the animal like taking off a glove from the hand. How much better things would be if this procedure was adopted, and made compulsory in all slaughter houses throughout India? As it is flayers refuse to co-operate just because they insist on sitting on the ground where they say it is cooler, and continuing with a practice which is inbred within them.

We want to labour the importance of correct and efficient flaying and the need for its enforcement because greater attention to this matter would also eliminate the mal-practice of leaving offal such as flesh, skin and fat clinging to the flesh side of the hide for the purpose of adding weight, as soon as the skins are removed from the animals in the slaughter house, they should be washed, facilities should be provided for this purpose on the premises, and all skins should be thoroughly salted before removal. We are of course fully aware that "green" skins taken immediately from the slaughter house to be worked in the Tannery often produce a superior grade of leather, but even if the skins are taken to the market beforehand, there is the risk of deterioration setting in; particularly in a hot Country like India, and the skins are very often stacked without shelter from the rays of the sun whilst awaiting sale or auction.

A great number of hides and skins which are produced in India are taken from dead and fallen animals, and here supervision and control becomes very difficult. Here is a case where our Government could help by establishing rural hide and skin collection centres where villagers could bring and dispose of their productions and they could be paid according to the conditions, and its state or preservation. This would provide some measure of control and at the same time villagers could be instructed how to conserve the value of the skins which they produce by employing better methods of preservation. These collecting depots could forward their intake of hides to larger assembly points where the hides could be graded according to quality and size and auctions could be conducted at frequent intervals. The production of suktees should be banned altogether, since the resulting product judged by modern standards is practically worthless.

Having covered the production and conservation of the valuable hide substance we are now faced with the major problem of transporting the hides to the tanneries situated throughout India, and since road transport facilities are practically non-existent we are driven to use the railways who have yet to appreciate that this traffic is highly perishable and that the wagon in use at present are totally unsuitable for the conveyance of hides and skins. The highest priority should be given for the carriage of hides and skins, to prevent loss through deterioration. It would perhaps be too much to expect the introduction of refrigerated freight vans, on our railways, but insulated and ventilated freight cars are a real necessity.

We now come to the problem of improving the quality of raw hides and skins which are being produced in India, and the lack of regular and adequate supplies of feeding stuffs retards any advance in this direction. The creation at Government level of a hide Improvement Scheme with Officers operating in the field would pay handsomely dividends providing these Officers were empowered to restrict breeding in places where foodstuffs were in short supply. This together with the compulsory improvement of stock through the acquisition of selected pedigree cattle, phased breeding and artificial insemination methods which are now being widely used in Europe & America would help to build up a more healthy and virile stock. Penning, and greater care of stock would eliminate most of the defects classified as grain damage present in Indian hides and skins to-day, such as tick bore holes; weal and wound marks, hot branding marks on the best part of the hide, thorn, and horn inflictions the incidence of which could be lessened if not completely eliminated.

To come back again to the methods of hide preparation, these are sadly lagging behind the methods employed in other South East Asian countries, where the method of preparation adds a high premium to the value of the skin. The methods employed in such countries as the Malay States, Thailand, French Indo-China, South China, Hongkong and Indonesia should be carefully studied by sending out a Government sponsored delegation on a tour of inspection. The desirability of bringing to this country a team of hide shavers (Fleshers) from any one of the countries mentioned to instruct for the training up of our own fleshers in the use of the Crescent shaped knife used for shaving should be given careful consideration. Frame drying

of hides in the shade should be made compulsory, and the drying of hides under the direct rays of the sun should be made a punishable offence.

In conclusion there appears no point in trying to improve the standard of quality of our dressed leather by the introduction of modern methods, and the use of the new tanning materials which are now available, unless we approach the subject from the right end, namely, the improvement and conservation of the hide stock from the moment it is removed from the dead animal. Therefore, we would like to summarise our views in the following way, and in this order :—

(1) Facilities should be provided in the slaughter house for hoisting up the dead animal with its hind legs uppermost in the air.

(2) Flayers should receive proper instruction regarding their work and should be made to qualify, and be licensed when proficiency is attained.

(3) Facilities should be made available at the slaughter house for washing and salting the hides and skins.

(4) The preparation of sukties should be banned.

(5) Government hide collection depots should be set up, and larger depots should conduct regular auctions of supplies drawn from the small hide collecting centres.

(6) Hide dealers should be made to flesh their skins, stretch, and frame dry their skins in the shade if they are not to be disposed of in the wet salted or dry salted state, even then they should be previously fleshed and washed before salting.

(7) High priority should be given for the conveyance of hides and skins on the railways and the introduction of special ventilated and insulated freight cars should be considered for their conveyance.

(8) The Government should be asked to set up a Hide Improvement scheme staffed by suitable Officers working in the field and endowed with the necessary powers to enforce their directives.

(9) Instructions in the care and treatment of stock and Improvements in stock breeding and rearing should be part of a campaign to be organised by the Government.

(10) A delegation should be sent to neighbouring countries in South Asia to study the methods of hide production and preparation there.

(11) A team of foreign hide shavers should be invited to come to India to instruct our workers in the use of the large Crescent shaped knife for hide shaving, and their methods of hide preparation and conservation.

Manual for proper Flaying, Curing and Carcass Utilisation

F. H. HOEK, F.A.O. EXPERT

Introduction :

Animals after death are highly perishable materials ; enormous loss is often caused through lack of care in respect of untimely flaying, inefficient flaying and curing of hides and skins in India. It is considered that fallen animals should be flayed immediately after their natural death, while no time should be lost in curing these hides in the most appropriate manner. The following points should be observed while flaying fallen animals in Gosadans :—

(1) Animals expecting their natural death within a short period should be kept separately from the healthy animals in the cattle sheds. Easy access to water and fodder should be ensured to these animals, while proper care should also be extended to them.

(2) Immediately after natural death—the carcasses should be shifted to the Charmalaya-section and transported by means of a suitable vehicle. Care should be taken that no damage is caused to the hides during lifting and transport.

(3) The Manager should keep proper control and account of the time of death and delivery to the Charmalaya-Section.

(4) On arrival in the Charmalaya, the carcass should be lowered in a skinning bed, placed below the hoisting apparatus.

(5) It is recommended to make a bleeding cut by severing the jugular vein in order to remove as far as possible non-coagulated blood from the carcass. Blood affects always the quality of the hide.

(6) Post-mortem examination should be carried out and the cause of death recorded—in case of a disease harmful to the Gosadan workers special precautions should be taken to protect the workers.

(7) The back-bone line of the carcass should face the floor. Buckets filled with water should be placed close to the flaying spot, while the door of the Charmalaya should be closed during the flaying operations. A bucket filled with a soda-solution should also be kept ready for disinfecting the floor immediately after flaying.

(8) The hide from the head is removed-by giving a cut just above the upper-lip and skinning upwards towards the horns—the latter are removed by an axe and stored in a special bin.

(9) The skinned head is finally removed from the neck and the skull hung on a hook attached to the wall.

(10) The four legs are subsequently flayed ; Hind-legs by starting from the hoofs and cutting the tendons on the back of the hind legs, which facilitates the skinning out of the legs downwards to and over the hockjoints. The tendon of Achille should remain attached

to the heel, the hock-joint is subsequently severed and the skinned legs placed in a bin. The forelegs are skinned out, starting from the hoofs over the knees, the knee-joint is also severed and the lower parts of the forelegs placed in a receptacle.

(11) The neck should be ripped from the lower lip towards the point of the breast in a straight line until the naval only. The hide just below the lower breast is opened for allowing warm air to pass out from the belly.

(12) The left fore-shank and the left hind shank are brought together, by the so-called shooks inserting one part of the hook between the tendon of Achille-pulling the same towards the left fore-shank and fixing the other part of the Shook through a hole made in the flayed hide from the fore-leg. The same operation is carried out with the right fore and right hind shank. The buttocks are brought into a stretched condition—the same would facilitate the ripping and flaying of the hind-shanks, buttocks and the fore-shank and neck-portion.

(13) Ripping cut is made from the right knee over the shoulder towards the point of the breast and again from the left knee over the shoulder to the point of the breast; both ripping cut-lines should be symmetrical. Care should be exercised that the point of the opener is not piercing through the connective tissue or the meat of the carcass while making the ripping cuts.

Ripping of the hind shanks and buttocks is done from the hock-joints in a slight curve along the udders—care should again be exercised that the ripping cuts from both the hock-joints are symmetrical. Above the anus a ripping cut is made downwards in a straight line from the first ripping cut towards the tail. The opener blade should be kept flat during ripping or the point of the knife should be directed slightly upwards, by which cutting of the connective tissue or meat is prevented.

(14) The hide is subsequently removed from the shoulder (mid-way), by pushing away the hide and careful knife-work. The hide should first have been removed from the inner fore-shanks and over the upper part of the breast, after which the point of the breast is cut in the midst-leaving the tissue on both sides of the incision in tact, the cutting is continued downwards over the middle of the neck following the red-meat of the neck, by which the wind and food pipes become visible. Both pipes are loosened by cutting first a piece from the wind-pipe and pulling the same with one hand, while running with the other hand along the pipes and piercing the same with the fingers and separating the pipes with an upward pull. The upper ends remain attached, three rings of the wind-pipe are severed and a knot is made with the foodpipe. This knot prevents manure coming out from the stomachs. This upper part of the breast is opened by an axe or a saw following the cut already made with the knife.

(15) Flaying of the hind-shanks and buttocks starts just on the angle made by the ripping cuts above the anus upwards to the left hock-joint and also downwards from the right hock-joint. The buttocks should be completely flayed without damaging the connective tissue and the meat or taking away meat along with the hide during

flaying. Subsequently the inner sides of the thighs are removed, keeping the hide stretched by one hand and using the knife carefully in the other hand—finally the hide of the udders or the testicles are flayed in the direction of the naval.

(16) The S.-hooks are loosened by cutting away the hide from the front side of the fore-shank—and in case the connective tissue is not severed during flaying and ripping, the removal of the hide from these parts is extremely facilitated. The sides are subsequently flayed by giving long strokes and keeping the hide in a stretched condition—leaving the red-meat on the carcass and not from the carcass along-with the hide.

(17) The belly is opened further—for the removal of the fatlob, stomach and intestines—the latter are loosened first and are removed at a later stage from the carcass.

(18) The carcass is lifted slightly to facilitate the flaying of the tail by placing the S.-hooks between the tendon of Achille and leg and pulling the chain pulley until the root of the tail is within easy reach of the flayer. An incision is made starting from the end of the tail downward, to the anus and the hide is loosened on both sides from the incision. The remaining of the hide is loosened by placing the hook between the hide and the root of the tail and pulling it to the flayer. The tail-hairs should have been removed first and stored in a special container.

(19) The carcass is hoisted completely out of the skinning bed, while the intestines have been taken out from the carcass and shifted into a cart placed in front of the carcass—Flaying of the back-portion is started from the hip-bone partly by beating with a smoothly polished bone and partly by knifework ; no fat should be taken away from the carcass and no cuts should be made in this most valuable portion of the hide.

The hide should further be removed from the shoulder until the same hangs down in a straight line, and adhered to the back-bone portion only. Finally the hide is also loosened from the back-bone line leaving the hide only attached to the neck ; the latter part of the hide is removed after inspection of the hide and meat inspection in slaughter houses. All precautions should be taken that the floor is kept dry and clean during flaying in order to prevent that the hide is contaminated with blood, moisture and dirt. The hide is finally inspected for possible damage and its weight is determined, the latter should be accounted for in a register and the weight marked on the hide—preferably just on the base of the tail. Branding of the animals takes place,—when animals are admitted to the Gosadans—this operation should be carried out by one of the workers of the Charnalaya Section, in order to ensure branding of the animals on the correct spots viz., the shank-portion or the hump.

Curing of Fallen Hids

Wet-salted method :

(1) Curing salt should preferably not contain calcium and magnesium salts or calcium and magnesium chlorides ; curing salt contaminated with the above chemicals is highly hygroscopic and affects the

quality of the raw hides ; addition of sodium carbonate to the above salt results in difficult soluble salt and or magnesium carbonate and calcium carbonate. The calcium and or magnesium content in curing salt calculated as sulphate should not exceed 1 per cent for light hides or 2 per cent for heavy hides, while the iron content (iron oxide) should not exceed 0.03 per cent.

Marine salt influences generally favourably the growth of bacteria and fungi, while rock salt shows better curing results.

(2) The particle size of curing salt plays an important role ; the following particle sizes are being used for hides and skins :—

Fine ground salt (particle size below 0.5 mm.)

Medium coarse salt (particle size from 1-2 mm.)

Coarse salt (particle size from 2-3 mm.)

The fine powdered salt forms easily lumps and so-called salt lakes on the flesh side of the hides/skins—the extraction of moisture is delayed while the brine formed on the hide should be drained off, the outer layer of the hide is dehydrated too rapidly, by which this layer is more or less closed and the moisture of the inner-layer cannot be reduced further, resulting in putrefaction of the latter layer of the hide or skin.

Coarse salt leaves marks on the hide, the grain is often damaged by large sized salt particles.

Medium coarse salt is recommended for curing cow hides or kips ; heavier hides could be salted with coarse salt.

(3) The moisture should be reduced gradually from hides ; heavy salting in the beginning closes often the outer-layer of the hide and retards further reduction of moisture from the rest of the hide.

(4) Fresh hides should be weighed prior to curing, they are opened and spread over a platform sloping slightly from all sides, special care should be taken that the shanks are opened properly.

Salt is sprinkled first on the floor or platform, the hide is placed with the hair-side down on the floor and salt is spread uniformly upon the upward flesh side—only 10 per cent of salt is used for the first application of curing ; salt-water is extracted from the flesh side and a diluted salt solution or brine is formed containing blood, salt, soluble proteins, etc. and the latter are drained off gradually from the hide. Blood should be extracted as far as possible as blood is a good medium for the development of bacteria, while elevated temperature and excess moisture are favouring also the growth of bacteria—the latter are highly detrimental to the quality of the hides.

The salted hides remain in the above condition for 1-2 days, subsequently the first salt application is shaken from the hides and fresh salt is uniformly spread on the flesh side—about 30 per cent salt should be used—leaving the hide again for 2 days in salted condition—followed by final salting and piling until the hide is fully cured—the same will cover a period of about two to three weeks—after which the hides should

be cleaned from loose adhering salt particles--the cured weight determined and bundled for despatch to the tanner.

(5) Curing and storing of wet-salted hides should be carried out in properly ventilated and cool godowns—the temperature should preferably be kept between 10 to 15°C, while the relative humidity should be maintained on such a level as to prevent shrinkage or drying-out during storage.

(6) Shrinkage or reduction in weight of hides during curing :—

Calf skins from 10-12 per cent.

Cattle hides from 7-10 per cent.

The total absorbed quantity of salt varies from 16-10 per cent on the fresh weight of the hides ; the water content is on an average reduced from 60 per cent to about 40 per cent in wet-salted hides, treated according to the above method of wet-salting.

The salt should have formed finally in the wet-salted hides a saturated salt solution (a solution of 35 per cent) with the remaining moisture left in the cured hides.

(7) Additions of certain chemicals to ordinary salt are being used to increase the curing effect on wet-salted hides and skins ; sodium carbonate, naphthalene, zinc-oxide, sodium silico fluoride, preventol, merpin etc.

(8) Ordinary salt complying with the required specifications is mixed with calcinated sodium carbonate—2 per cent on salt, or sodium carbonate crystals—5% on the salt weight for obtaining a better curing effect. The reaction with litmus paper is alkaline, the pH—9.9. Addition of naphthalene to salt-soda mixture should have a still better result in curing. Thorough mixing of the above chemicals is of paramount importance—otherwise this mixture would act adversely on the quality of hides and skins. Salt stains, red-violet discoloration and bacterial growth could be prevented to a great extent by using this mixture in an appropriate manner—the first salt application could be ordinary salt only, while the second application could consist of the above mixture.

(9) Ordinary salt mixed with zinc-oxide—1.25 per cent on the salt weight should also increase the keeping quality of the wet-salted hides—especially when the hides/skins are being stored over longer period.

(10) Sodium silico fluoride is being used for disinfecting hides and skins derived from areas in which contagious and communicable diseases of rinderpest or of foot-and-mouth disease are being found, by immersion of the hides for not less than 24 hours in a 1 to 7,500 solution of sodium silico-fluoride.

(11) Preventol Liquid 1 from 0.5—0.75 per cent on salt weight or Preventol (ON) sodium orthophenyl phenate, tech. 0.5—1 per cent calculated on the weight of the salt should increase the bactericidal action—preventol diluted with water should be sprinkled over the salt and thoroughly mixed with the salt prior to application on the flesh-side of the hide. The reaction is alkaline and shows pH. 9.9. to 10.1

Salted hides should preferably be stored on salted gratings and under cool conditions—while pilings should not be excessively high—4 feet.

Merpin S extra 40—2 per cent calculated on the weight of the salt and mixed with salt should retard or eliminate salt stains and discoloration of hides and skins—diluted Merpin could also be sprayed prior to final salting over the flesh side of the hide using 1 to 1.5 per cent on the weight of the hide, while having removed first the salt particles—the final salting takes place after the Merpin solution has been sprayed over the hide, and a quantity of 20 per cent of salt is being used for re-salting. Development of bacteria and fungi would be stopped, while red and violet-discoloration would even so be prevented.

Curing of hides and skins according to the so called brining method :—

Hides and skins should be washed immediately after flaying and treated subsequently in a concentrated salt solution during max. 24 hours. The strength of the salt solution varies from 23 to 24 Beaume ; it would be advantageous to keep fallen hides first in a diluted salt solution for one hour or so, in order to extract as far as possible blood and to prevent further postmortem changes and to immerse the hides subsequently in a saturated salt solution during 24 hours.

The next handling concerns draining over poles to remove excess liquor followed by final salting of the hides—using about 60 per cent salt calculated on the weight of the hides—the floor should first be covered with salt, while a few salted hides are piled and folded along the backbone line—these hides form a so-called cordon, after which the remaining hides are spread out flat, with the flesh side upwards and sprinkled with salt.

The salt used for piling can be utilised again for subsequent salting without danger. In small production centres re-salting and piling with 20 per cent salt would be more advantageous, as the brined-cum-wet salted hides are generally not kept in store by small hide-producers over long periods. Addition of chemicals to increase the bactericidal action of the brine-solution might be useful viz., 5 per cent of soda calculated on the weight of the salt and/or 1 per cent soda on 33 per cent salt solutions during brining of the hides ; especially while treating fallen hides—all efforts should be made to stop and prevent post-mortem changes and further development of bacteria.

Dry-salted cure of hides and skins :—

The curing of hides according to the dry-salted cure appears to be simple—but actual practice has shown that in dry-salted or air-dried hides serious defects are most frequent—mainly due to faulty handling of the hides prior and during curing.

The following rules should be observed :—

(a) The hides should be properly cleaned viz., adhering meat, fat, dirt and blood, should be removed before curing.

(b) The hides for dry-salted cure should either be immersed in a saturated salt solution during 24 hours, or the hides could be spread over a sloping platform and sprinkled evenly with 15 per cent salt and kept as such for one day—loose adhering salt should be shaken from the hide, while brined hides should be sufficiently drained prior to air-drying. Khari salt is often used in certain parts of India and it should have the advantage of keeping the hides more dry than hides treated with ordinary salt. The sodium sulphate content of Khari salt reaches a fairly high figure and this is why this salt is less hygroscopic than ordinary salt. However, Khari salt is contaminated with varying amounts of harmful matters viz., silicates, calcium carbonate, magnesium oxide and when applied as a paste, it forms a kind of concrete layer on the hide.

The weight of Khari-dried hides is often falsely increased by this paste up to 40 per cent. Similar cured hides are not of good use to the tanners, possible flaying defects and other damages are hidden by the above concrete layer, while difficulties are often encountered in the soaking back of plastered hides by the tanners.

Hides air-dried cured only, should be treated as mentioned under (a) and subsequently immersed in a 0.25 to 0.3 per cent solution of sodium arsenite—to protect them against the ravages of the so-called hide or skin beetle and of the moths; the use of naphthalene in addition to arsenic is also recommended, when the latter has been applied by sprinkling after drying—in case it is not possible to arsenicate or to salt hides and skins, it is advisable to sprinkle powdered white naphthalene, which should be free from tar-products.

(d) The hides and skins should perfectly be dried in the open in suspended condition between frames or by suspension from poles; the latter are placed in a line running east and west—the hind shanks and the butt portion attached by means of ropes to the horizontal pole erected about 5 feet and more from the ground, while the fore-shanks and neck portion are attached by ropes to pegs in the ground placed along the shadow line made by the horizontal pole. The drying between frames and from poles is recommended especially during the dry, hot season and care should be exercised that the sun strikes the flesh side not directly, while free circulation of air on both sides is imperative for satisfactory drying of hides and skins. The common practice of drying fresh hides over the ground or over branches of trees through which so-called crumpled hides are produced, should be discouraged in the villages—this method is very unsatisfactory—putrefaction between the wrinkles is produced during drying, while blisters or rottenness between the inner and outer layer of the hides penetrate the leather often completely during processing.

Shade drying of hides would be beneficial during the most hot period in the month of May from 10 a.m. to 4-30 p.m., in order to prevent possible over-drying of the outer layer of the fresh hide on the formation of an horny layer. The properly carried out dry-salted cure should not only increase the keeping qualities of dry-salted hides during storage, but they should also wet-back very nicely in the wet-house process, provided coagulable proteins are being removed before actual drying—and the proteins are not allowed to denature before treatment with salt. The air-dried cure of fallen hides (without salt) could be improved by washing the hides thoroughly in a bath basified first to pH 10.5 and

11.5 by sodium carbonate and the addition of an antiseptic viz., 0.1 to 0.2 gram para-meta-Cresol per 1000 c.c. water or 10 to 20 gram per 100 liters. Hides derived from animals suffering from foot and mouth disease would be disinfected by the above washing or treatment, while possible bacterial development prior and during drying under suspension should also be prevented to a considerable extent.

Drying of hides on the ground is uneven, as only one side is exposed to air movement and moreover, over-heating may occur. The relatively high temperatures varying often from 50 to 70°C during the hot season in certain parts of India, which are exerted on the moist hide may cause two types of change, both of them depreciating the quality of the hide or skin to a considerable extent—viz. direct heat damage causing a physical change in the hide fibres and putrefactive damage due to the action of micro-organisms. Insect damage is mainly caused by one species of beetle, *Dermestes vulpinus* known as hide-beetle—while ants have also been known to attack dried hides and skins. In Indonesia and Africa—dipping of the hides in solutions of arsenic is being carried out at the larger centres—and usually by the exporters. During the last decade—less poisonous insecticides have been developed and the same are more appealing than poisonous arsenic solutions.

Conclusions : ●

The majority of the mechanical and putrefactive damage which occurs in hides is avoidable and should be attributed mostly to the carelessness or ignorance of the producers.

Rapid flaying of the hide after the death of the animals should be encouraged, as putrefaction usually arises from delay in flaying, cleaning after flaying and leaving the hides in pools of blood (slaughter houses) often covered with blood dung and filth ; the action of putrefactive bacteria commences then rapidly—as such whenever water is available the hides should always be thoroughly washed to remove any contamination of blood, dung and dirt. Correct ripping lines are of paramount importance. Incorrect ripping lines result in so-called “bad pattern”, the same indicates that the line of the backbone is not perpendicular to the rear-end of the hide. Moreover, the consequent inclusion of parts of the belly leads to a reduction in the quality and hence in the market price of the leather which is produced. Adequate attention should therefore be paid to the correct ripping of the carcasses—the same applies obviously to the correct skinning or flaying of the hide—leaving the connective tissue on the carcass together with meat and adhering fat.

In organised production centres—it should be possible to apply an antiseptic to the wet hide or skin before it is put out to dry or immediately after it has been put on the frames. The same will do much to reduce the action of putrefactive organisms.

In centres provided with brining pits the brine-air-dried cure could be adopted and the same is especially recommended for fallen hides, in order to reduce as far as possible the action of blood contained in fallen hides.

The wet-salted cure is beneficial in case the wet-salted hides can be transported to the tanneries within an appropriate period, in order to prevent putrefactive damage during transport.

The brine-wet-salted cure should be advantageous to the leather producer—as the veins should be less apparent, the weight of the hides should also be lower than of wet-salted hides due to less or no loose salt adhering to the hair-side of the hides, while the yield of brined hides should be more than in ordinary salted hides—for example the surface area should on an average exceed the area of ordinary salted hides by about 5 per cent, while the leather yield should reach a figure of about 8 to 10 per cent more than of sole leather produced from ordinary wet-salted hides.

It is known that salt acts only as a deterrent to the propagation of bacteria present in all hides, without being able to destroy them completely, while again many kinds of bacteria develop an immunity to even high concentrations of salt—to this effect the bactericidal action is being increased by additions of the Preventol types to the salt and by another bactericide the so-called Merpin-WS-extra-40. It is claimed that the latter destroys every kind of bacteria present on and in the hide or skin.

The International Hide and Allied Trades' Improvement Society has recommended during its annual congress in Paris last September, the salt with soda and naphthalene mixture for the curing of hides, as being superior and more practicable than others.

The mixture should contain 2 per cent of soda and 1 per cent of naphthalene—larger percentages of soda should be added if the salts contain more than the normal amount of calcium compound; while this mixture should be used on hides up to 50 lbs. and for calf-skins, similar salted hides should be left in pile for at least 14 days.

The salt with soda and naphthalene cure has been practised in the U. P. Government Training Centre and U. P. State Gosadans with very good results since three years—this method yields to a valuable improvement and its use may be extended over the whole of the country especially in large producing and collection centres.

Air-drying by suspension method should be adopted at least in all Government sponsored centres and propagated in the field because (a) it is a quick, cheap and easy method for Indian Rural conditions, (b) chemicals are generally not available in sufficient quantities in the villages, (c) transport charges on dried hides and skins should be lower than on wet-salted hides, and (d) no special attention has to be paid in respect to storage—except that the dried hides are not exposed to humidity or rains during transport,

Investigation on the preparation of Neatsfoot oil.

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Abstract: Fresh cattle legs were cleaned, scraped, washed, chopped and boiled with water in an open pan for about 12 hours. The supernatant oil was skimmed off and treated with brine and left overnight. Next morning the oil was separated and again treated with cold water and left for two days. Then the oil was separated and filtered, which showed a yellow colour and had a bland taste. On analysis the oil was found to compare favourably with imported stuff.

Neatsfoot oil is generally obtained from the feet of cattle and is a very valuable material in the leather industry, specially in the manufacture of glace kid. The oil, however, is not yet manufactured in India but its manufacture is desirable in view of the proposed development of glace kid industry in this country. An attempt was, therefore, made to evolve a suitable method for the preparation of genuine neatsfoot oil.

In order to ascertain if the oil could be extracted from cattle hoofs, a quantity of dry cattle hoofs was obtained from a local dealer, thoroughly cut into small pieces, washed and boiled with water in an open pan heated by direct fire for about ten hours. It was observed that no oil separated out. The hoofs were again boiled the next day for the same length of time but no oil separated out, proving thereby that hoofs did not contain any neatsfoot oil.

Then a certain quantity of fresh cattle legs (called in vernacular Tengris) was obtained from the local salughter house and stored overnight. Next morning the legs were carefully cleaned by scraping and washed, the hoofs cut off, and the legs were chopped into small pieces and then boiled with water in an open pan heated by direct fire for about twelve hours. Precautions were taken to see that there always remained a certain quantity of water in the pan, otherwise the oil oozing out of the legs would be charred by the heat of the dry pan and would thus be coloured dark due to oxidation. During boiling the oil extracted from the legs rose to the top of the water and was skimmed off from time to time by means of a suitable skimmer. The oil was then taken in separating funnels and brine added to facilitate the separation of the water. The mixture was allowed to separate overnight. Next morning the brine which separated at the bottom of the funnel was run off and the oil which remained in the funnel was again mixed with cold water in order to remove any fleshy substances which might still be mixed with the oil and the mixture allowed to separate for a couple of days. After this the bottom layer of water and other deposited matters were run off. The separated oil was then filtered. The oil thus prepared was of a yellow colour and had a bland taste.

Another method was tried. A certain quantity of fresh legs or Tengris was obtained from the local slaughter house and stored overnight. Next morning the legs were carefully scraped and washed, the hoofs cut off and the legs were chopped into small pieces and then heated along with a little water in a double-jacketed water boiler for about ten hours, the steam issuing out of the boiler through the small opening being diverted into the mixture of legs and water by means of an India-rubber tubing. The oil rose to the top and was separated and treated in the same way as before. But contrary to expectations, the yield of oil in this latter case was less than in the former case and moreover the oil was also of a darker colour. The former method gave a yield of about $\frac{1}{2}$ oz. oil from 1 lb. of legs, whereas the latter method gave a yield of about 0.3 oz. oil from 1 lb. of legs. Hence the first method is more suitable and should be adopted.

The oil made by the first method was then analysed along with a sample of imported neatsfoot oil and the results obtained were as follows :—

		<i>Our sample.</i>	<i>Imported sample.</i>
Density	...	0.910 @30.5°C	0.910 @30.5°C
Acid value	...	0.73	5.80
Saponification value	...	164.20	162.20
Iodine value	...	32.94	29.40

The oil along with the imported sample was also subjected to a cold test of 12°C and it stood the test well, both starting solidifying at about 10°C. A method of making neatsfoot oil has been worked out.

Byc-products from the slaughter houses and their Utilization

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Abattoirs and slaughter houses, built on modern lines in foreign countries, have proved to be veritable gold mines because all meat by-products, including edible and non-edible offal as also wastes of other types are systematically collected and processed, and nothing is thrown away without thought to its possible value. Greater utilization of the by-products has made it possible to pay the producer a higher price for the livestock purchased and to sell the finished products to the consumer at a cheaper price.

With the growth of meat-packing plants in advanced countries, the war on waste began in right earnest. Science found new ways of using by-products, as they constitute some of the most important raw materials of value to industry.

Life has been lengthened for people suffering from diabetes, anaemia and other diseases by the uses of drugs such as insulin, liver extract and pepsin, all made from animal glands. But for the painstaking care of meat-packers, these glands would go to waste. In short, great strides have been taken in conserving and utilising by-products, and each new use for by-products adds value to livestock and proves beneficial to producers.

Unfortunately in India, by-products, barring a few like liver, spleen, kidney, brain, testes etc. remain largely unexploited. The reason is that most of the slaughter houses in the country, generally speaking, are badly constructed and ill-equipped, highly insanitary and totally lacking in essential facilities like light, water, drainage, and protection from flies, crows, vultures, rats, mice and other pests.

Besides, slaughter houses are planned and run on the principle of each butcher controlling his own operations, with the result that no attention is paid to the proper conserving and utilising of glands and by-products like fat, blood, bones etc. In many instances, they are wholly wasted, particularly in rural area.

Meat By-products :

In what way by-products are useful and how they are processed is indicated briefly below :—

Blood :

It contains nitrogen, phosphorus, calcium etc., and blood meal constitutes an important feed for pigs and poultry. Blood, with its nitrogen content, is also a good fertilizer, particularly for grape and coffee plantations.

Bones :

These have a large variety of uses. Hard bones can be shaped into buttons, combs, toys, Knives and umbrella handles. They can also be ground and used for the manufacture of tallow, glue and bone-meal, each having important uses: tallow in the textile and soap industries, glue for making ply-wood, book-binding etc., and bone-meal as a fertilizer.

Fats and Lanolin :

They are the base of many cosmetics, creams and beauty aids and are also used in making soap, glycerine, candles, lubricants, paints varnish etc.

Glue and Gelatine:

These are produced from bones. The oldest and widest use of glue is in the furniture and veneer industry. It is also used in sizing paper, in the manufacture of wool, silk and other fabrics and the making of emery paper, picture frames, dolls, toys, leather goods etc.

Gelatine comes in useful in the manufacture of confectionery, ice-cream and jelly as also in certain pharmaceutical preparations and the making of capsules for medicine etc.

Guts :

The intestines, when washed and cleared of fat etc., are called guts. They are used for commercial purposes such as the manufacture of sausages, catgut for use as surgical ligatures, strings for tennis and badminton rackets, musical instruments etc.

Hides and skins :

They go into the making of boots, shoes, bags and other leather goods.

Horns and Hoofs :

They are an important source of keratinous wastes of commercial significance. Cottage industries in this country have already established a reputation for the manufacture of combs, buttons, handles, filigreed boxes etc. From the shavings and dust resulting from these operations, slabs and tiles could be prepared after proper treatment, as also air foam solution for fire extinguishers.

Lard and Tallow :

Lard has uses outside the kitchen. It is useful for illumination, lubrication and in the manufacture of chewing gums, soap etc.

Tallow is used extensively in the textile and soap industries.

Wool, hair and bristles :

Wool goes into the manufacture of worsted wollens, blankets, carpets etc.

Hair makes beltings, ropes and upholstery paddings.

Bristles are extensively used in the making of brushes of various kinds.

The waste water from slaughter houses also contains valuable material, from which oil and semi-solid residue can be recovered. The oil is used as tallow for textiles, soap, lubricants and similar purposes. The semi-solid residue can be dried and used as fertilizer or as feed.

Source of Hormones :

These by-products apart, animal glands and organs are a sources of hormones, which have come into increasing use in modern medicine. Recently, it has been found that the lining membrane of the pig's stomach contains 'haemopoetin', now widely used for pernicious anaemia in man. Adrenalin is a powerful heart stimulant, highly valued for medicinal purpose. The demand for glandular and hormone preparations is increasing at a tremendous rate all over the world.

Looking to the large-scale slaughtering that goes on in this country, there are vast potentialities for preparing biological products from the endocrine glands of the animals slaughtered. But little is being done so far since slaughter houses do not have any cold storage facilities, which are essential for preserving glands from the time of slaughter to the time of removing them to factories.

The conditions under which animals are generally being slaughtered in the country today are also such that the proper collection of glands and by-products is rendered difficult. Slaughtering is being done to a very great extent at small, scattered and unrelated centres.

Prompt Treatment :

From the foregoing survey, two important facts emerge. In the first place, it is clear that from the standpoint of technique, all waste is avoidable. The second fact is that the extent to which it is economically possible to utilise these products varies with the degree of concentration of the raw materials.

It is obvious that the secret of the production of standardised high grade animal by-products lies in the prompt treatment of the raw material. Animal offal starts decomposing soon after slaughter and depreciates in value. So, the processing must begin immediately after slaughter, and no raw material should be left over at the end of the day. It is necessary that slaughter houses should be modernised, so that the required by-products can be removed in times and preserved in cold storage for distribution.

In order to make sufficient quantities available for further processing on a profitable basis, the centralization of slaughter is essential.

It is also necessary that the processing plants should be installed near slaughter houses. These units can become economically possible only in large towns such as Bombay, Madras and Calcutta and where the number of animals slaughtered is at least a thousand a day.

Central slaughter houses :

The first need, therefore, is to rid the country of a number of small, scattered and highly insanitary slaughter houses and construct modern central slaughter houses in all cities and big towns and lease them for a period of, say, five years to one authority on conditions such as (1) that all animals must be examined and passed for slaughter (2) that all meat sold must be classified and graded and (3) that all glandular and other by-products are collected and processed according to the latest methods.

There is no doubt that the development of up-to-date public slaughter houses or large modern centralised slaughter houses would make possible the more efficient utilisation of by-products and save enormous quantities of raw material which are now being wasted.

In view of the national importance of the question, it may also be necessary to set up appropriate machinery to supervise the collection and distribution of glands and by-products at a reasonable price to manufacturing firms. In highly industrialised countries like the United States, the United Kingdom, Holland etc., co-operative organizations have made substantial headway, and there is no reason why, given the urge and the necessary facilities, they should not be successful in this country too.

Marketing Board:

It is further suggested that a Marketing Board, consisting of representatives of processing firms, butchers and the municipality concerned, be constituted at big slaughter houses to control and supervise the collection, preservation, and distribution of animal by-products. All the by-products should be purchased by the Board at an agreed price and treated at the premises. Such a concentration of slaughtering in fewer and better equipped units will secure for the meat industry the economics and efficiency enjoyed by its oversea competitors.

To sum up, the rapid utilisation of animal by-products calls for the establishment of modern central slaughter houses with suitable equipment for dealing with edible and non-edible offal, the systematic collection, preservation and processing of glands, blood, bones, hoof, horns etc., rigid and rigorous meat inspection, provision of cold storage facilities and up-to-date methods of converting waste into wealth.

Valuable to Economy :

Meat by-products are very valuable to our National economy. They can be gainfully converted into national wealth by processing them.

Systematic utilization of these by-products can provide employment to a considerable number of rural and urban folk. In science lies the salvation of our people, as much in the field of food as in any other.

Products of slaughter house and their uses

S. VENKATARAMAN, C.I.R.I.,

Abstract The products that can be obtained from a slaughter house are discussed and the various uses to which they can be put to are given.

With the introduction of the ban on slaughter of animals in almost all the States of the Indian Union, the Leather Industry has now to face a serious problem of getting good raw hides. It is by experience known to all those connected with this vital industry, which is responsible for a foreign exchange of about 20-25 crores of rupees per annum, that good leather cannot be produced from bad hides. The hides that are obtained from the cattle, which have had their natural death, are found to be inferior to those obtained from slaughtered ones.

Considering the economic problems of India, it may seem legitimate that cattle should be slaughtered. It is a well-known fact that India occupies a unique position in the world as far as cattle population is concerned. But at the same time it is deplorable to note that the amount of milk and the weight of hides that are got from these cattle are very meagre and as such it is not economical to keep them in large numbers.

Further, in India, the people are not in a position to make their both ends meet due to the shortage of food articles. Due to this reason, some of the barren lands and some lands now under fodder crops are being brought under food crops. This would necessarily mean that the grazing area available would decrease to a great extent and as such this would tell upon the quality of the cattle.

Now, the problem that stands before us is whether to have more cattle of inferior quality or a lesser number with a better quality. Obviously, the answer to this question would be lesser number of cattle with a better quality.

It is here suggested that slaughtering can be done as a means of reducing unwanted cattle such as discarded bulls, culled cows etc. and this may directly and indirectly help India in raising her economic status.

The advantages of slaughtering are enumerated below :

Meat Industry :

¹Farm animals contribute to the welfare of mankind, by producing food, clothing, power or recreation. Of all these, food is the most important. Nearly half of the human food supply is mainly got from animals. The food got from animals includes meat, milk cheese etc. Cattle is slaughtered mainly to get meat. The demand for this perishable product, namely, meat determines the amount of cattle that is to be slaughtered to a very great extent. Though cow and beef meat do not have a market in India, a market can be explored outside India, for example, in Pakistan or other countries. With the improved methods for storing of perishable articles (cold storage) it is now possible to store meat without any bacterial action for a number of days. Further it is to be noted that if cattle is not slaughtered then there is the likelihood of rise in prices of many articles, including shoes.

When we consider India, it is seen that meat can provide food for many persons. Also the creation of foreign markets for this commodity would help India to earn some foreign exchange which can be utilized for other useful purposes.

Blood Manure :

Dried blood is a very effective manure containing about 14% Nitrogen. The drying of blood can be easily carried out with the help of lime. The blood manure can be collected in slaughter houses. Though in India people do not use this due to sentimental objection, we can find new markets for this commodity and thus this by-product is also very useful.

Hide and Skin Industry :

Hides and skins, which are got as by-products of the meat packing industry are responsible for 22-25 crores of rupees per annum of foreign exchange. This industry is now struck with a deathblow with the introduction of the ban on cow-slaughter in almost all the States. This had made the amount of available good hides for tanning to decrease and this may have a serious effect on the foreign economy.

Uses of Leather :

Considering the uses of leather, it can be said that there is nothing like leather. It is so because the leather has a variety of uses.

Leather is mainly used for footwear. With the advancement of civilization the demand for footwear has increased considerably. Leather is used for the preparation of fancy articles and also for some useful articles like travel bags, Ladies' hand bags etc.

It is also used in industries as picking bands, roller skins etc. It is used as a strap for watches also. Harness and saddlery are made out of it. Gloves and sports goods are also made from the same.

To quote D. Woodroffe "Leather possesses many valuable qualities. It is the strongest of flexible materials available for common use and owes the phenomenal strength to its marvellous physical structure. It is capable of withstanding severe friction and heavy strain. It is a light weighing, pliable, durable, more or less water resisting, not readily inflammable, easy to join or subdivide, workable to the hardness of iron or the softness of cloth, porous and a perfect protection against wind, this material is a possession of inestimable value to the human race."

Leather bags are used in deserts as water carriers. Thus we see that leather is put to a variety of uses and it may not be possible to enumerate the uses because with the advancement of civilization the uses to which leather is being put is fastly increasing.

Hairs :

Hair is very useful in the making of the felt and other useful materials. It is also seen that bleached hair has a very good market.

Leather Board :

Leather waste, which is quite common in this industry, is presently being utilised for manuring purposes. But if the leather wastes are made useful in the production of leather boards, this may be able to fetch 10 times the amount that is fetched now.

Gelatin :

Gelatin, which is an organic nitrogenous colloidal protein substance, is mainly of three kinds : (i) edible, (ii) photographic and (iii) inedible. The edible gelatin has become a widely consumed food. It is also added to ice-creams to retard the crystallisation of sugar when the ice cream is prepared. Gelatin is also used by pharmaceutical houses for making capsules and as an emulsifier.

The photographic gelatin is used in motion picture industry. The gelatin is coated on the film-base as the sensitized emulsion of the light sensitive silver salts. Inedible gelatin is used for miscellaneous purposes such as sizing paper, straw hats etc.

Glue:

Glues are made chiefly from waste products of the meat packing and tanning industries, such as fleshings, bones, trimmings and materials unsuitable for the manufacture of gelatin. They find use in match, automobile, paper and rug industries and also in carpet sizing and in the production of imitation leather.

Phosphate Industry :

Phosphorus has now to be imported from other countries and the demand for the same has increased considerably during the last few years due to the rapid expansion of many industries, including the match industry. Since the availability of phosphate rock is limited, India has to think about other methods of getting phosphate. The bones of animals are rich in Calcium phosphate and as such these can be used for the manufacture of phosphorus and Super-phosphate got from Phosphorus can be used as a fertilizer. Other uses of Phosphorus and its compounds apart from the above mentioned ones are in medicine ; it is also used to soften water. Phosphate esters are good plasticisers and so are used in plastic and lacquer industries. Among the miscellaneous uses of Phosphorus, it is used as an alloying agent, as a refining agent in petroleum industry. Thus it is clear that the bones that are obtained as a by-product of this meat industry can be exploited to the full extent and this may add to the sum total of our National Assets.

Bone Ash :

It is used as a decolorising agent, especially, in sugar refineries.

Horns :

The horns of cattle are also useful for making fancy articles, buttons and combs.

Neatsfoot oil :

The skin, bones and feet of cattle (exclusive of the hoofs) are cooked in water for 10 hours to separate the fat. This is skimmed off the top of the water and after filtering through cloth heated in a kettle to 250°F. for several uses. The kettle is cooled, the contents are settled, the oil is drawn off, filtered through flannel bags and then refined. This product is Neatsfoot oil. The pure variety is used for oiling watches and other fine machinery and the impure one in the textile and leather industries.

In addition to the above mentioned ones, there are very many by-products of the slaughter industry. Information relating to these will be published elsewhere.

Conclusion :

From the foregoing it will be seen that the products of the slaughter house are mainly meat, hides, horns, hoofs, bones, fat etc., got from the slaughtered animal. From all these, various products like combs, buttons, leather and fancy articles, fertilizers, glue, gelatin etc., can be

prepared in village centres. If these small industries are developed they would provide not only an additional income to the village chamar or the mochi who depends solely on hides, but also provide employment to many others. This will go a long way in ameliorating the economic condition of the village chamars who form a large proportion of the population of India.

Acknowledgment

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Salt-curing of fresh slaughter house hides

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The aim of this paper is to explain the considerable advantages we have derived by modifying our process of salting green hides received from slaughter houses.

Introduction :

We receive considerable quantities of fresh green hides from the Bombay slaughter houses.

Old salting procedure :

Our previous procedure was that the hides received from the slaughter house were washed free from blood and extraneous matter and trimmed. A hide was then laid flat on the floor with the hair downwards and a liberal coating of crushed powdered salt was applied on the flesh side. Necessarily the salt had to be spread by hand and care taken to see that no part of the hide was left unsalted. One hide was piled on to the next one, foreshank to foreshank, the grain side always being downward, making a pile of about 100 hides.

Since the centre portion of a hide is always thicker than the belly, such a pile always became higher in the centre and sloped away to the sides. The result was that the salt tended to drain away.

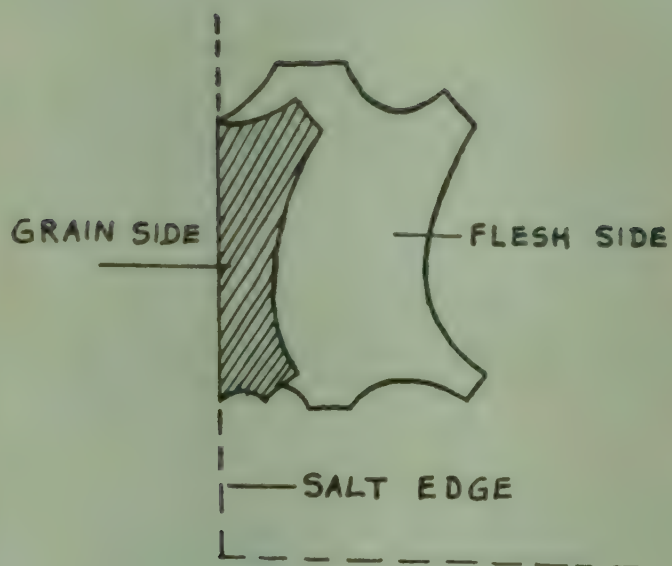


Fig -1

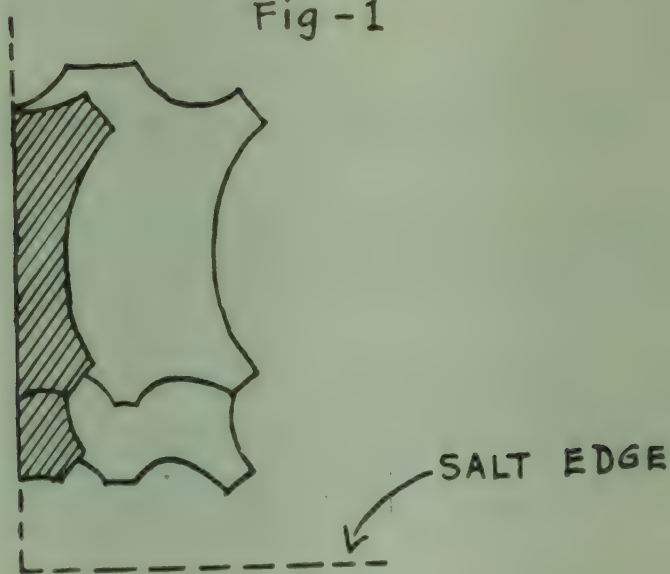


Fig II

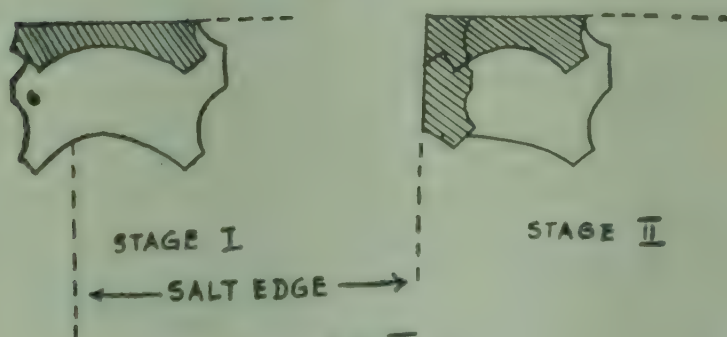


Fig III

The next day, another coating of crushed salt was applied, the hides folded into two along the backbone and put away for storage, piled one on top of another.

New salting procedure :

An area is chosen measuring about 20' \times 10'. On it, a thin layer of uncrushed salt is spread to a thickness of $\frac{1}{2}$ ".

The aim is to make a pile of hides on this area to a height of $3\frac{1}{2}$ —4 feet.

The pile is started by laying a hide with the grain down on the floor and sprinkling uncrushed salt all over its surface. It is then folded parallel to the backbone to the extent of 25% as shown in Fig. I.

Fig. I.

The folded edge is laid along any one edge of the salt rectangle. The next hide is similarly laid but to cover the previous one about 75% as shown in Fig. II.

Fig. II.

This is continued till the hides have covered one side of the rectangle.

In order to form the right angular corner of the pile the hide has to be folded twice as follows, taking care that the inner folded edge is well packed with salt. Otherwise, putrefaction is likely to occur.

Once the corner is formed, hides are again placed along another edge and the process repeated till the entire perimeter, the perimeter and a depression in the centre of the rectangle. At this stage hides are laid fully spread out with the hair down in the centre starting from one end of the rectangle and moving down as follows : Each hide is sprinkled with salt before the next one is placed on it.

Fig. III.

When the centre of the pile is in level with the perimeter, hides are again laid along the perimeter and the whole cycle repeated till the pile becomes about $3\frac{1}{2}$ —4 feet. high.

This pile is then allowed to lie for any convenient period from one to four weeks, depending on the availability of space.

Experimental :

Two lots of 50 hides each were taken upon receipt from the slaughter house in the green condition, roughly about two hours after they had come off the animals back. .

They were trimmed and weighed, (fresh weight). After washing blood etc., off the hides, they were salted according to the above two methods.

After a week they were weighed. In the case of the old method, all the salt was absorbed. In the new method, however, there was considerable amount of excess salt. So the hides were shaken once so as to remove the excess salt and then weighed.

The hides were subjected to the identical liming process, fleshed in the same manner and weighed.

<i>Results.</i>	<i>New method.</i>	<i>Old method.</i>
No. of hides	50	50
Fresh weight	1567 lbs.	1733 lbs.
Total salt used	666 lbs.	444 lbs.
% salt used/fresh wt.	42.5	25.62
W.S. weight after one week	1271 lbs.	1390 lbs.
Limed wt.	1750 lbs.	1792 lbs.
% W. S./fresh wt.	81.12	80.21
% Limed wt./fresh wt.	111.69	103.42
% Limed wt./W.S. wt.	137.68	128.91

Conclusions :

For those receiving large quantities of cow or buffalo hides requiring salting either in the fresh or W.S. condition, described above for the following reasons :

(1) It eliminates two applications of salt as well as double handling of hides.

(2) Once the pack is completed, it can be left in that state for even four weeks without any heating up.

(3) The hides on coming out of the pile are perfectly cured with a pleasing appearance.

(4) As the liming results show, there is a far better lime yield both on fresh and wet-salted weight.

(5) Although salt required is greater, a considerable amount of it is unabsorbed. It can be shaken off, dried in the sun and re-used.

(6) Wet-salted hides from such a salting process do not heat up as easily on storage as the others do, nor do they develop "red heat" as easily.

(7) The salt used percolates through the entire pile of hides. It does not flow away.

Economic utilization of carcasses in India

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Most obvious things are sometimes least noticed and the work of carcass utilisation including proper flaying and curing of fallen hides is certainly one of the same. Due to certain social and religious reasons this work has not received proper attention for ages past with the result that most of the carcasses are not utilised at present and are generally either reduced to heaps of bones by vultures and dogs or are allowed to deteriorate on the spot where the animal has died. The non-utilization of all the carcasses is a serious national waste, as well as a source of spreading contagious diseases amongst human beings and livestock in surrounding areas. The net value of this waste in the country comes to the tune of about 22.5 crores of rupees annually. The hides of fallen animals are the main product in our country, but they too are very often spoilt to such an extent that these fallen hides cannot be converted into a good quality leather. The loss sustained by defective and deteriorated hides is estimated at about Rs. 5 crores per annum. As such, the total net loss amounts to 27.5 crores of rupees annually. Obviously if proper utilization of carcasses is made and flaying and curing of hides—especially of fallen variety, is improved, it would not be too much to say that the industry could be of great help in reducing the poverty from the country and contribute a lot towards making country's economy more sound.

Since about 2.5 crores of dead animals are found scattered over the whole country representing an area of 12,69,690 square miles, the country is faced with the tremendous problem of collecting the carcasses and arranging their proper utilization. Besides, the non-existence of proper means of communication, the vastness of the country, the numerous small villages with an average cattle populations of about 350 heads and an annual number of deaths of 25 cattle per village, extreme poverty of the people who are the sole custodians of this business and their utter ignorance of the improved methods of handling a carcass are other factors influencing adversely the economic utilization of carcasses in whole of the country. These basic facts should not be overlooked while studying the possibilities of introducing carcass utilization in rural areas. The peculiar circumstances under which the carcasses are available in this country involve enormous difficulties which may perhaps seem insuperable, but nevertheless, much can be done to overcome them by sustained educational efforts.

The State of Uttar Pradesh possesses about 23.5 million adult cattle and buffaloes. At the usual death rate of 10% about 2.35 million carcasses are available per annum in this State. If all the fallen carcasses are properly utilised, instead of allowing them to deteriorate, about 20,000 tons meat meal, about the same quantity of bone meal, 2,200 tons of tallow, 1,100 tons of guts and 2,200 tons of horns and hoofs can be recovered from this sources,

The above quantities of meat, bone, horn and hoof meal have the capacity of fertilizing 2.5 lakh or acres of land give additional yield of about 27,800 tons of food grains every year. Besides the above waste, huge monetary loss is also sustained by the State due to faulty flaying and defective curing of hides and skins.

In view of the seriousness of the situation and magnitude of the work involved, the State Government secured the services of Shri F. H. Hoek, an Expert in this field, through the good offices of the Food and Agriculture Organization of the United Nations. He made a careful survey of the whole situation and advised the State Government to establish, in the first instance, a Rural Hide Flaying, Curing, Carcass Utilisation and Training Centre which was established in October 1952 at Bakshi-ka-Talab, Lucknow, in addition to the existing 4 Mobile Hide Flaying parties which have been operating in rural areas of the State. The chief aim of the centre is to provide instructional facilities to artisans and instructors for the training in the improved methods of flaying, curing and economic utilisation of carcasses. In order to provide carcasses for practical training, arrangements have been made to collect fallen animals from the city of Lucknow by providing free lifting and transport facilities.

Since its inception in October 1952 the centre has shown an appreciable progress, during the period ending June 1956, 16467 carcasses of cattle, buffaloes, horses, sheep and goats have been collected and processed at the centres resulting in an yield of 563 good quality hides, 15904 first class skins, 14934 lbs. meat meal, 14626 lbs. bones, 522 lbs. tallow, 844 lbs. blood manure, 12 lbs. tail hair and 36 pairs of first quality of buffalo horns. The total receipt obtained from the sale of various by-products amounted to Rs. 35,497-10-0 including Rs. 732-4-0 received as tanning charges.

Besides, this rural centre imparted training to 218 artisans and instructors belonging to this State and 13 Gosadan workers deputed by Government of India from the States of Madhya Bharat, Madhya Pradesh, Punjab, Assam, Bihar and Vindhya Pradesh. Due to its useful activities and the success it has achieved so far, the centre is regarded as the Pioneer in setting up a model carcass utilization and training institute not only in this State but also in whole of the Indian Union.

The above 4 hide flaying mobile units move from village to village, state by state, imparting training to the village flayers by giving practical demonstrations and making educative propaganda in respect to the collections and marketing of better quality hides. Improved flaying tools and wooden frames for proper flaying and curing of hides and skins respectively are also awarded by the staff of these units, free of cost, to the deserving trained flayers in the villages.

As a result of continued practical demonstrations and educative propaganda, the above parties have trained 1976 village and butcher flayers and given 5376 practical demonstrations during the period commencing from 1949-50 to 1955-56. 818 improved flaying tool sets and 270 wooden frames have also been awarded free of cost to the trained flayers. Besides, due to the strong educative propaganda a large number of village flayers, who had abandoned their business of collecting fallen

hides, have again resumed their work and numerous idle hands have been able to work and contribute to the saving of our national wealth. It has been observed that a well-flayed and cured hide can easily fetch an additional price of Rs. 4 over the sale proceeds of an ordinary one. The above trained flayers can produce at least 1,20,000 well flayed and cured fallen hides per year, thereby increasing their gross total income by about Rs. 4.80.000.

Most of the fallen hides are produced in rural areas where unskilled technicians, who belong to the poorest class of the Indian society, spoil this raw material to such an extent that a good quality leather cannot be produced from these hides and the carcasses are also allowed to go as waste. With a view to overcome the above draw-backs and also to organise the work of flaying and curing on more sound basis the department made efforts and persuaded the trained village flayers to organise themselves into co-operative societies. As a result, 10 village flayers co-operative societies have so far been organised in various parts of the rural areas. A sum of Rs. 6,000 is also given to each of these societies in order to enable the village flayers to arrange necessary improved flaying tools and other articles viz. bone digester etc. required for full and economic utilisation of the carcasses.

Over and above this, 'Charmalaya' sections have also been established at the 2 State 'Gosadans' under the hide flaying scheme. During the period, under reference, 2266 first class cattle hides, 64,416 lbs. bones and 46 lbs. tail hairs have been produced at the above Gosadans. So far Rs. 15,415-2-0 have been realised from the sale proceeds of hides and other by-products and an appreciable quantity of these by-products is also available in the stock, the value of which is estimated at about Rs. 12,000.

In this way, a great success has so far been achieved in this field through the hide flaying scheme and Bakshi-ka-Talab centre.

Production of Hides and Skins

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There has been considerable improvement in tanning processes during the last few years in our country, thanks to the efforts of the Central Leather Research Institute and other Research Organisations as also some enterprising Commercial concerns, but methods of production of hides and skins and also curing, storage and transport thereof have remained practically as they were long time back. To add to that cow slaughter has been banned in most States and so the quality has further deteriorated. This state of things—more due to lack of organisation than ignorance—is bound to affect largely the benefits accruing from Research, even though we may be doing tanning with atomic wastes in not perhaps a very distant future. It is impossible to strengthen a house with improved superstructure, if the very foundation is defective. Likewise it is impossible to get good leather out of

bad raw material. Although much has been said and demonstrated about the remedies it is still perhaps worth while to repeat them in the back-ground of my experience in extension work for the last 20 years.

For cow hides we have now to depend more and more on fallen stock collected in rural areas. Many of us are probably aware that the pattern of hide collection in the villages is passing through a transitional period. Those who have been doing this as their family trade are no longer attracted by the carrion which they used previously as food, and the hide alone very often of inferior quality being from old, deceased and emaciated animals is not worth the trouble and labour involved in carrying the dead animal from the Owners' house and flay it. As a result many animals are flayed late and many are abandoned unflayed to affect the village sanitation. Due to indifference and various other reasons, the Village Chamar has been seldom able to attend to curing and storing of hides properly and it is now time that the job of hide production should be transferred from him to some other organisation capable of handling it in a better way. My suggestion is that the work could perhaps be entrusted to the village school, which is taking up various trades in its curriculum and aims, as its routine duty at keeping the village clean. Besides taking of the hide, preparation of Meat meal and Bone meal should also be undertaken. Dr. Soni suggested that the stock owner could be educated for the proper up-keep of the animal and its hide. The idea is most welcome, but it may be difficult to convert him easily. I would therefore suggest to start with the child. Let him have a page or two in his text book describing simple measures for the proper care of the animal, decrying such cruel practices as branding or goading with a whip tipped with an iron nail describing how to carry the animal to the disposal ground and flay it and finally dispose of the carcass. Necessary apparatus and equipment consting about Rs. 3,000 may perhaps be made available from various sources. The Village Panchayat may make it incumbent on each village to carry the dead animal to the disposal centre at his own cost or alternatively pay for carrying it. School boys coming from different parts of the villages are supposed to carry information about the death of a cattle to the school timely so that prompt disposal of the carcass may be possible. In a dead cattle disposal centre run on an experimental scale at Cuttack the following results have been obtained.

Period of work.		Number of ani- mals disposed.	Expendi- ture including labour.	Yield of meat meal & value.	Yield of Bone.	Tallow.	Total recipt.
1 month	...	30	Rs. 90	390 lbs. Rs. 50	420 lbs. Rs. 30	...	Rs. 80

About 30 animals were received during a month. As it is not obligatory that all the carcasses should be brought to the centre, about twice this number are flayed elsewhere and are lost to the centre. Flaying is done first on a frame to facilitate opening of the hide and then by hoisting the carcass. The meat is then boiled in a carcass boiler, under a pressure of about 30 lbs. per sq. inch. for some time when the tallow comes out and floats on the surface and the bone is separated from the meat. The tallow is removed by opening a stop cock provided for the purpose. At this centre however, there was no yield of tallow

as the animals were quite emaciated. Water is squeezed out of the meat with the help of a cylindrical screw press with a number of holes in the cylinder to allow the water to get out. The meat is then dried under cover of wire netting frames in order to ward off flies. When it is quite dry, it may be powdered or may be kept as it is, according to the wishes of the customer. If it is intended to be used as manure or food for fish it has to be powdered and if it is to be used as food, for poultry or dogs, it may be left as it is. The bone may be digested by a bone digester and then powdered, but at Cuttack as cost of fuel and labour charges are high, digestion cost is comparatively heavy, so it has been found more economical to crush the bone by the hammer mill, a mobile unit of which is available from the Agriculture Department which charges at Rs. 50 per ton of bone meal. This centre has not yet been self supporting partly due to higher labour charges and cost of fuel. Moreover, the hides belong to the Chamars and have to be paid for at market rates. All the carcasses are also not available to the centre. In villages, however, conditions are likely to be otherwise. Labour will be free, fuel may also perhaps be available free of cost or cheaply. So, although supply of animals is not expected to be as high as in the town, it will run at a profit. If a large number of carcasses are dealt with in this way it will be quite easy to cure the hide timely—either by wet-salting process, or if salt is costly, merely by drying in the sun on a vertical frame placed parallel to the direction of the rays of the sun.

Coming to skins, the importance of which cannot be ever emphasized, a lot has to be done. In the rural areas, on account of some improvement in living standards a large number of goats and sheep are now being killed but there is little or no arrangement to regulate the killing. In many parts, where the butcher is a Hindu, killing is done in such a way that the skin loses the pattern acceptable to the trade and fetches a very small price. In urban areas, slaughter houses are mostly ill-equipped. The flayer generally works in piece rate and so the speed of work is of major consideration to him and not the skin. The owner is also not much concerned in many cases as either the skin has been presold or he has fixed up only the meat of the animal and has got to return the skin to the merchant who supplies the animal. This lack of interest accounts for the incidence of a large number of flaying defects in the skin and although much has been said and done to prevent this defect, there has been little improvement. Following steps are suggested to eliminate this defect in urban areas.

(1) The owner of the slaughter house, Government, Corporation, Municipality, Union Board or whichever body may it be has to make it imperative that any flayer damaging the skin by cuts beyond a permissible limit continuously for a certain period should be debarred from operating in the slaughter house.

(2) Instead of permitting the owners to take away the skins to their own houses for subsequent curing, it is suggested that curing should be done in the premises of the slaughter house, and space with locking arrangement should be made available there on rent to keep skins of individual Cutchers. This will facilitate quicker curing, uniform grading, better storing (a cold storage may perhaps be visualised if the number of skins is quite large) and better marketing because

of assembling of a large number of skins at one place. From sanitary point of view, it is also good to have the godown at one place instead of having it attached to the owners house and scattered all over the town.

It is not necessary perhaps to discuss on hides from slaughtered cows and buffaloes, as with the ban on cow slaughter, the matter has lost much of its importance. It is suggested that these slaughter houses should also be organised in a similar way as those for the goat and sheep. If the number of animals killed is fairly large, about 50 per day, electric flaying knives are suggested which ensure very quick operation and there is absolutely no flaying cuts.

Before closing, a few words are necessary about the transport. The Railways do not consider hides and skins putrescible matter in the same sense as fish or fruits are reckoned, which though partly justifiable, accounts for undue transit delays at times and decomposition of stock. Transport in steel wagons also accounts for considerable loss due to decomposition. There is rarely suitable storage place at Railway Stations to keep the hides at the time of forwarding or clearing and many must have been familiar with the scene of bundless of hides and skins lying at one distant end of the platform under the sun or rains with dogs and crows feasting on them. This state of affairs is continuing from year to year. The suggestion of Experts to provide wagons lined with wooden planks has not materialised. Probably the Railway Board has been confronted with similar demand from various other trades and apparently are unable to make decision about priorities. Dr. Nayudamma suggested yesterday to use inexpensive paper packing for the hides to reduce the damage to hides to some extent due to heat. I would however like to go still further to suggest that straw might be put inside the wagons as lining by the consignors while despatching hides. This would provide fairly good insulation against heat. The question of providing storage facilities at the Railway Stations need not perhaps be stressed now that food grains and even salt suffer from the same disadvantage. It is however suggested that there should be underground or other suitable accommodation as soon as funds are available.

Flaying, its present position and some suggestions

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Introduction :

The art of removing the skin or outer covering of animals and preparing it, by trimming to shape and cleaning, for salting or drying is known as flaying. Flaying has been done on dead or killed animals from time immemorial ever since man was created. When man was created, he felt the pinch of hunger and had to live by hunting. He then felt the fury of the elements, cold and rain and had to protect his body and he did so using the hides and skins of animals which he killed for his good. This was the beginning of flaying and incidentally of the Leather Industry.



Fig. 1—CATTLE.
Correct lines for ripping.



Fig. 2—SHEEP.
Correct lines for ripping.

The ideal to be aimed at in flaying is to produce a hide or skin of good pattern entirely free from holes, cuts, scoring and gougings and with no adhering fat or flesh. But even though flaying is older than the art of leather making, it has not yet been properly perfected and is the Cinderella of the Leather Industry. So much so, in South India, about 25 lakhs of rupees are lost annually due to faulty and improper flaying.

This is partly due to the (1) ignorance of the butchers, (2) improper wages that butchers are paid, (3) bad tools with which they work, (4) pricing of hides by weight and (5) in the case of fallen hides, the chamars are totally ignorant of the technique itself.

The butchers in the slaughter houses are for the most part uneducated and do not know the great loss the Leather Industry suffers as a result of faulty and careless flaying of hides and skins. Some of the butchers as a result of long experience are adepts in the removal of hides and skins but their economic conditions are so miserable that they constitute another factor for the deplorable conditions of flaying in this country. The butchers in this country are not employed by any Government or quasi-Government machinery but by meat contractors or meat shop owners who pay them not according to their efficiency or ability but according to the amount of work they turn out, e.g. a flayer between 3-5 p.m., a shop assistant during 6 a.m. to 11 a.m., and a livestock broker for his employer from 11 a.m. to 3 p.m. In some shops they act as coolies and carry the butchered meat to the meat shop. In a few localities there are butchers paid, not for their efficiency, but according to the quantum of work done. They are paid at flat rate per hide, irrespective of whether the work turned out is good or bad and naturally the quality has to be sacrificed for quantity. As the hide or skin is a bye-product, it is natural that the flayers should pay more attention to dressing meat attractively than to obtaining a first class hide or skin. The economic condition of the butcher is again responsible for the queer use of steel plate in the place of butchers' knives. Hides and skins merchants have also to be blamed for fixing the prices of the hide by weight and not according to the quality of work. Only the weight of the hide is taken into account and therefore the butchers mix the hide with blood and excreta to increase its weights not knowing the havoc done to the hide as a result of this practice.

Scientific flaying:

A well-flayed hide is nicely squared and symmetrical in shape. The flesh side is clean with no trace of knife marks, holes, cuts or gougings. The following is a guide to the correct flaying of a hide; a sharp knife should be used. The bleeding cut should be made in a perfectly straight line between the breast and throat. A cross cut will spoil the shape of the hide and decrease its value. The opening cut must be made with the great care. Fig. 1, shows the correct lines to follow in ripping. Any deviation from this will make it necessary for the tanner to trim off parts of the pelt before tanning. The parts so removed cannot be used for any purpose except glue manufacture, where their value is very much less than when sold as leather. After the opening cut has been made, the knife must be used carefully to avoid cuts and holes, "Niggling" with the point of the knife

should be avoided as it produces bad results. Care should be taken in removing the tail bone and root as hides may be damaged during this operation. The legs should be cut off at the knee joint and the horns, skull and muzzle should also be removed. If flaying has been done properly, there should be an absolute minimum of fat and flesh adhering to the hide.

Calf Skins :

These being much thinner and more delicate than a hide, are easily damaged. Great care is required for them. The lesser the knife is used, the better the result. Fisting can be done with advantage. The lines of ripping are the same as those for hides, calf skins should be flayed without the head.

Sheep skins :

A properly flayed sheep skin should be square in shape. Fig 2 gives the lines for ripping. The knife should be used as sparingly as possible. The rest is done by fisting. In the "Case-On" method, open out the skin and allow to cool.

Goat skins :

Use the knife as little as possible. If done by the "case-on" method, open out the skin and allow to cool.

Suggestions for improvement

1. Slaughtered hide

(a) Slaughter house :

1. A lairage provided with shade and plenty of water should be provided for the animals to rest.

2. The slaughter hall should be of the "booth system" and should not be open hall.

3. The animals should be brought into the hall one by one and then slaughtered.

4. Each animal should be carefully and quickly cast and slaughtered. In no case should an animal see another animal being slaughtered.

5. Some method of stunning should be adopted in the slaughter house, prior to slaughter proper.

6. The floor of the hall should be hard, non-slipping and easily cleansible.

7. After slaughter, the blood should be carefully collected and not allowed to mix with the hide and alimentary contents. Each booth should have a blood channel.

8. The intestinal and ruminal contents should not contaminate the hide. There should be separate rooms for guttery and tripery operations and the guts and tripe should be carried in wheel barrows to these rooms.

9. Each animal should have a hoisting apparal if possible a flaying bed and tail extractor also.

10. There should be plentiful supply of water for washing and cleansing hides and skins.

11. A separate room should be provided where hides and skins could be stored or cured and stored. It would be ideal if this room has cold storage facilities.

12. The slaughter house should be well lighted, ventilated and have fly-proof arrangements and the walls should of glazed tiles to facilitate easy cleansing.

(b) The animal slaughtered :

1. Should be allowed at least a 24 hour period of rest in the lairage.
2. Should be permitted to drink copious amount of water.
3. Starved for a period of 12 hours.
4. Should be quickly and carefully cast before slaughter.
5. Stunning prior to slaughter would be ideal.

(c) The butcher :

1. Should be a licensed one. Experience and a theoretical knowledge of scientific flaying should be the basis for licensing.

2. Should be provided with the following essential articles which should always be clean, polished and sharp, where necessary.

(a) A flaying knife (about 6" long with a slightly curved blade).

(b) A ripping knife (about 6" long with a straight pointed blade).

(c) A ' butcher's steel ' (about 10" in length and made of steel).

(d) A small axe with a cylindrical head.

(e) A saw for sawing through bones.

(d) General :

1. In many countries organised efforts have been made with a view to improving the general standard of flaying. This can be carried out either by penalising bad work or encouraging good workmanship. All this could be done in India only if the butcher or flayer is employed by a Government or quasi-government organisation on

decent wages. But first and foremost legislation should be taken up for the licensing of butchers and the supply of standard instruments.

2. For the improvement of flaying, the Madras Government sanctioned a Flaying School. This school commenced functioning in March 1953. The school imparts training to butchers and amateurs for a period of 3 months and includes practical as well as theoretical training in flaying. About 60 students are trained annually. The school has auxiliary centres in the mofussil where Veterinary Assistant Surgeons are in charge. The theoretical training is held at the Madras Veterinary College and in the Veterinary hospital. The practical training is conducted in slaughter houses. After the period of training the candidates undergo an examination in theory and practical and successful candidates are awarded certificates. So far 232 amateurs and butchers have been trained and issued certificates.

3. When once licensing of butchers is legislated, flaying competitions could be conducted by the trade preferable in each slaughter house and good work could be encouraged by offering rewards to those who produce creditable results. This method has been adopted in the United Kingdom with good results.

(e) Mechanical flaying :

4. It is reported that several machines are now in the market. The general form of these machines is more or less the same. The machines are usually electrically operated and consist of a flaying tool which is held in the hand and connected by means of a flexible lead to a dynamo or other source of power. The cutting surface consists either of revolving blades guarded on the safety razor principle or two circular plates with blunt edged teeth which oscillate in opposite directions. These machines are reported to have proved efficient in practical use, in different countries. These could be installed in major slaughter houses in India. The use of the machines has so far been confined to hides in those countries.

5. In Libya improper flaying of a hide has become the subject of law whereby a flayer responsible for bad flaying can be punished with deterrent punishment.

(f) Grading of hides :

6. Now that there are trained flayers in the Madras State it is high time that grading of hides is taken up. At the time of meat inspection, the officer-in-charge of the slaughter house should examine the hides as well both the flesh side and the grain side and record the defects found on them. The forms should be numbered and the number on the form should be stamped on the hide. The hide should also indicate the origin of the take off i.e. in which slaughter house it was obtained. The tanner or hide purchaser should be permitted to go through these records before purchase of hides.

7. Soon after introducing grading classification of flayers should be taken up. Flayers removing hides without any damage are classified as first class flayers. Flayers who cause some damage

to the less valuable portions of the hide as second class. Flayers causing damage to the valuable portions of the hide as third class. Licensing should then be done according to the classification and the first class flayer designated as Master Flayer. Where sufficient numbers of master flayers are not available then the master flayer should perform the ripping operation and the flaying of the back. The second class flayer the belly portion and the third class flayer allowed to flay the head, neck and legs. These flayers should be paid according to their classification and records be kept for their work. Carelessness creeping in should be punished and good work encouraged by promotion or increments or bonus.

II. Fallen hides and skins.

One should not lose count of the fact that the above improvements are only for slaughtered hides or "Butcher Hides" and that they form only 15% of the total hides and skins in India. The rest 85% the majority are made up of fallen hides and skins.

"Fallen" hides and skins are derived from animals which have died from either disease or starvation or natural causes or which have been slaughtered in extremis. As these form a large majority more attention should be paid to this section of hides and skins.

(a) These hides and skins are taken off the carcasses by usually the chamars who are novice totally ignorant of the technique itself. These people should be demonstrated and taught the technique. A scheme has been put up by me and is under consideration to train these people. For this trained flayers should be recruited and each flayer should remain in a village for 10 days teaching the art of flaying and demonstrating the same to the chamars. This will of course take a long time, but it is better to make a beginning in the near future.

(b) It would be a good idea to start a co-operative hide and skin flaying centre in a group of villages. This centre should serve the villages within a radius of six miles and should possess the flaying instruments, hoisting apparatus, and facilities for carting dead animals to it. Curing may also be taken up in these centres.

Elsewhere in India especially in Uttar Pradesh there are flaying parties visiting villages, doing propaganda and giving lantern lectures and even demonstrating but since most of the chamars are ignorant and illiterate it is better to confine to demonstration alone.

Conclusion:

Before concluding, I wish to put before you the well known fact that the quality and value of good leather are to a great extent influenced by the quality of the hide. You are aware that the defects caused in the initial stage (i.e. flaying and subsequent handling of a hide) cannot be improved by the best methods of tanning. Therefore it is more and right to pay as much attention to flaying as has been paid to tanning as (1) a better flayed hide will not only fetch a better price but will raise the economic condition of the primary producer and (2) from a better flayed hide a finer quality of leather can be produced. The prosperity of the Tanning Industry of India depends on the flaying operations and techniques adopted.

Some problems relative to raw hides and their suggested remedies

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Abstract : The various defects in the methods of flaying, curing, collection, distribution, Transport and marketing of raw hides are described with suggestions for improvement.

Farm animals, which include cattle, sheep, goats etc. contribute to the welfare of mankind by producing food, clothing power or recreation. Several useful articles like bones (Phosphate Industry), Hides (Leather Industry), Blood Manure, Gelatin, Glue, Neat's foot oil etc. are obtained from dead cattle. From all the above it can be concluded that cattle is an asset to any country and it is a form of National Wealth.

Cattle position and its quality :

Though India possesses about one third of the world cattle population and a good per centage of goat and sheep population, it is seen, that due to various reasons (e.g.) non-availability of fodder-crops, improper breeding lack of sanitation, malnutrition, common occurrence of parasitic and bacterial diseases like Scabies, Rinderpest, Pox etc.), the quality of the cattle is very poor when compared with those of other countries of the world. Since the quality of the cattle is an important factor that has to be considered in the livestock industry and its connected industries, it is very necessary to improve the quality of the same. Useless cattle can be advantageously slaughtered to provide more fodder crops for the rest of the animals. Alternatively, cultivation of more fodder crops, artificial insemination (envisaged under the II Five Year Plan of the Government of India), better sanitation and dissemination of scientific knowledge to cattle raisers (by way of films) would improve the quality of cattle to a considerable extent.

Leather Industry and its problems :

The quality and the quantity of hide are important factors which have to be taken into consideration in the leather industry. The quantity of hide that would be available for the leather industry would largely depend upon the number of animals slaughtered for the purpose of food, namely, meat. It is also to be noted here that the demand for hides does not necessarily bring in an increase in the production of the same unless it synchronises with the increased demand for meat. This dependence makes the leather industry more unstable.

The price of the hide is also an important factor which requires our attention. In a finished leather, it is seen, that the price of the hide (to about 70% or so) is more than all the other charges put together. This high price for hide is due mainly to the defects in the methods of flaying, curing, collection, distribution, transport and marketing of the raw hides.

Flaying of hides :

The taking-off the hide or skin from the carcass of the fallen or slaughtered animals is familiarly known as flaying. Even this process requires technical skill as otherwise the hide may be cut through making holes or deep knife scores and this may deteriorate the value of the hides. In India, since this operation is at the hands of uneducated and un-killed people, the country is losing enormous amounts.

Curing of hides :

The process of preserving the hides for a length of time is known as "curing". Usually, certain salts like khari salt, which is an earth salt containing Sodium Sulphate, are added on the flesh side of the hide as curing agents. Khari salt, if not pure, may cause unwanted stains on the hide and it may deteriorate the value of the same. Also, if the salt is not applied properly throughout the hide, it is quite likely that some of the portions, where salt is not properly applied may putrify. This defect again is a cause for the loss of a large amount of money to our Nation as this operation is at the hands of some indigenous tanners and chamars, who are usually uneducated and financially backward.

Collection of hides :

In India, unlike many other countries of the world where hide is obtained as a by-product of the meat packing industry, hide is obtained mainly (as much as 85 % or so) from fallen animals and so the collection of hides constitutes a problem. The number of fallen animals usually fluctuates according to seasons, diseases in that area and with various other factors.

In India, the collection of hides is mainly carried out by Chamars, a group of uneducated people belonging to the lowest strata of society and whose ambition and intelligence are limited and who are poor and cannot wait for a better turn of market. These chamars, who are responsible for the collection of hides, usually take possession of the hides from fallen animals some time after their death and as such there is every possibility of the quality of the hide to deteriorate because putrefaction might have set in by that time. In certain cases, the hides of fallen animals are lost due to religious feeling of many people because the fallen animals are left as a prey for vulture and other birds in the fields. Also some of the animals meet their death while grazing in the forest area and in other places which are not easily accessible and as such an enormous quantity of hides is lost to the industry. In certain seasons, many animals may die all at a time and the collection of hides become difficult. All these things go to show that due to the unscientific method of collection of raw hides, the country is losing enormous amounts. The suggestions for the scientific method of collection of hides is discussed elsewhere in this paper.

Distribution of hides :

Due to lack of proper methods of distribution of raw materials, namely, hides to the tanner and shipper, there is no regulation in the production of the same. Also due to the seasonal demand for leather from foreign countries, unemployment in certain seasons has become

a common feature of this industry and unemployment in any form of society is a social, criminal and colossal waste of not only the productive capacity but also of the National Wealth. In the present methods of distribution, the raw hides pass through a number of hands before it is tanned into leather. (chamars, village beoparis, town dealers, tanners and exporters). In the passing of hides through a number of hands, a time period is also involved. So the loss sustained due to this defective method of distribution is two fold (i) due to delay in time and (ii) due to the price of the hide. Here it should be noted that due to the time taken in the passing of the hides through a number of hands before it actually reaches the tanner, the quality of the hide is also liable to deteriorate. These make the price of the hide to soar high. Also due to improper distribution of hides, the small tanners have to suffer as they are not in a position to compete with the big tanners.

Problem of Transport and its importance :

The transport charges for the raw material or the finished product contribute much towards the cost of the product and as such this factor should not be overlooked. The raw hides required for the leather industry are to be imported from different parts of the country e.g. the hides required for E.I. kips are to be imported from North India especially from West Bengal. The non-availability of transport and that too at the right hour makes this industry more unstable. Also in the case of transport of hides by iron wagons in the railways, iron stains occur on the hides as this as such deteriorates the quality and so the value of the hide. Delay during transit is also an important factor which has to be taken into consideration. Thus we see that the role played by transport as an integral part of the economic system is widely recognised.

Problem of Marketing of Raw Hides :

In the preparation of raw hides for market, it is seen that an enormous amount of money is being lost to the country due to defective flaying, curing, collection and distribution of hides. Improper packing of hides also causes some salt stains, red heat etc. which deteriorate the quality of the same. Delay in transit and the non-availability of transport go to make for the elasticity of foreign markets. Financial difficulties make this industry more unstable. The lack of finance makes the tanners adulterate their hides and thus the material cannot be graded according to quality. Since leather has to face a lot of substitutes for leather and also with other leather producing countries in the international markets, this industry should be set upon a scientific basis.

Some suggestions to improve the quality of Cattle and to minimise the defects in the methods of collection, flaying, curing, distribution, transport and marketing of hides are outlined below :

The Animal Husbandry Department may have its branches throughout the State under its jurisdiction. Every branch may have its jurisdiction over 8-10 villages depending upon the population, proximity etc.

of the villages. Every branch should be under the control of a Veterinary Officer. The functions of such a branch are :

(i) It should collect the statistics of the existing cattle in that area. The number of cattle dead during a period and the cause and nature of death should be also noted.

(ii) Free Medical help may be given to cattle in that area and they may be guarded from infectious diseases like Rinderpest, Pox and Scabies. Here the help of III and IV B.V.Sc. students may be sought. This would not only give them (students) an experience but this would also be of immense help to a national cause.

(iii) Scientific method of maintaining the cattle should be demonstrated to the villagers by the Veterinary Department (branch). The villagers should be made to understand the utility of cattle and its products.

(iv) The Animal Husbandry Department, in co-operation with the Ministry of Agriculture should make arrangements for fodder resources to the cattle of a particular area.

(v) The branch or 5-8 branches together may have a common slaughter house where useless cattle can be slaughtered. Besides hides and skins, other by-products like Bones, Horns, Blood Manure etc. should be utilised and the by-product industries may be organised on a district-wise basis.

(vi) Flaying operations should be under the supervision of the Veterinary Officer-in-charge of that area. He should demonstrate the correct method flaying to the flayers. In this connection it can be pointed out that the Veterinary College students, who have already undergone the practical training in flaying (IV. B.V.Sc.) may supervise this flaying work in addition to the other duties of a branch for about 2-3 months.

(vii) Better curing agents should be used. Care should be taken to see as to whether curing has been done uniformly and properly.

(viii) Every branch may have sub-branch to look after the uniform collection of hides and skins in that area. The hide collector alone should be authorised to collect the hides and a nominal sum may be paid to the owner in lieu of the dead cattle. The chamars may be partly employed as hide collectors. This may decrease the Rural under-employment and unemployment to some extent.

(ix) As far as storage of hides is concerned, for every 10 branches or so, there may be a common storage to preserve the hides until they are distributed to the tanner or for those who are in need of it.

(x) The collected, cured and preserved hides are distributed through the distributing agencies of the Animal Husbandry Department (the branches themselves may function as the distributing agencies as well) after sorting the hides according to the quality. There must be a fair distribution of hides to one and all at a fixed price depending upon the quality and the grade of the hides. A cut throat competition should not be encouraged and the big tanners should not be allowed

to monopolise. As far as possible, decentralised method of distribution may be adopted.

(xi) As far as transport of hides are concerned, for short distances lorries may be used. Hides, being perishable in nature, should be given priority to other commodities. The number of wagons available may also be increased according to the demands for this commodity. The Railway Rate Policy may be adapted in such a way as to give a fillip to this industry. The delay during transit should as far as possible be minimised. Instead of iron wagons, wagons lined with wood may be supplied for the transport of hides to check the loss due to iron staining etc. Refrigerated Railway wagons will be an ideal measure for the safeguarding of the raw hides which constitute a part of the National Wealth.

Waterways should be used as far as possible because this mode of transport is cheap. Delay during transit and delay due to unloading should be checked.

(xii) Export of raw materials to foreign countries should be discouraged so that this industry may gain a lot of money by finishing the hides within the country itself. The leather that is exported should conform to the standard laid down by a council which is set up by the co-ordination of the State and the Centre. Adulteration and other malpractices should be as far as possible checked. New markets can also be explored in foreign countries through the help of the Trade Commissions of India in many parts of the world. The requirements of the several countries may also be communicated to the tanners by them to manufacture the types of materials required by the consumers.

Though at first sight it may seem that this agency would involve an enormous expenditure and also administrative difficulties on the part of the Government of India, in reality this method would bring in a lot of money which otherwise is lost to the country.

By all the above suggestions the quantity and quality (e.g. wastage due to defective methods of collection, curing etc. are checked) of the hide available for tanning purposes would increase. The cost of the hide may also decrease by a considerable extent. This would make this industry a flourishing one and the Indian Leather can compete with substitutes for leather and with the other leather producing countries in the international markets.

By the above, educated and uneducated unemployment may be solved to some extent. Uneducated people may be employed (either partially or wholly) as hide collectors and for other similar work. The by-product industries should be started in rural areas and this may bring in a decentralisation of industries in rural areas. This may decrease the pressure of population on a few important cities and this may go a long way in rural industrialisation of the country.

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Improving the cattle wealth especially goat and sheep.

A. B. NARAYAN, MADRAS.

More than 90% of goat and sheep skins are derived from the slaughtered animals and the annual production figures for goat and sheep skins in India are 22 million and 16½ million pieces respectively. For the past 10 years we have not been having seasonal rains and so we were not able to get good quality skins due to natural poor grazing. Fortunately last year though South India received seasonal rains, yet we were not able to get good quality skins which will give (1) good substance, weight and reasonable assortment (i.e.) good selection.

By this not only the South Indian Tanner is a loser but from an economic point of view South India will be losing this year many crores of rupees, due to poor selection and lesser yield though the season has started for good quality skins now.

The following are the causes :—

(1) The goats were allowed before to graze in different fields in the adjoining forest. It is not so now.

(2) In the case of sheep most of the grazing grounds have been converted into paddy fields and no arrangement has been made for grazing ground for sheep and the nett result is that we get emaciated skins due to poor grazing. It is suggested that the Government should take the matter immediately and see that grazing grounds are available for sheep near the villages. In the case of goat the Forest Department must make arrangements to allow the goat to graze in certain portions of the forest reserved for goat. Thorny shrubs must be removed in the forest during the hot season so that the goat will not get scratches in the body. Scratches in the skins will bring down the selection resulting in lower prices.

It is understood that the livestock of goat and sheep in Tamil Nad alone has come down by about 1½ a million.

As our sheep skins are best in the world and as our Finance Minister assured aid for the Leather Industry, it is hoped this aid will be extended immediately to livestock also, so that economically South India will be benefitted.

Monsoon Defect

This occurs during the months of October, November and December in Tamilnad. So, raw skins purchased during the above period show very low selection i.e., 60% of the skins will come under Fifth and inferior fifth and rejections. The price of raw skins come down by 100 to 150 rupees for every 100 skins. It is suggested the Veterinary Department take up the matter and as soon as the monsoon is over the animals may be given proper treatment to heal the monsoon defect in the skins so that the wealth of the country may be increased.

**Preservation of raw skins in the slaughter house
before sending to the tannery by cart for
salting.**

Usually when the skin is removed from the animal it is washed to get rid of dirt, dung and blood and then sent to the tannery. If the skins reach the tannery within two hours after washing the yield is not very much reduced. If the skins reach the tannery after two hours, the yield is less especially during summer season. This is due to bacterial action as it has not received any disinfectant (preservatives). Generally for every 10 skins if the expected yield is 6 lbs., the tanner loses $\frac{1}{4}$ to $\frac{1}{2}$ an lbs. As the South Indian tanner sells by weight the yield is an important factor. To get expected yield or weight it is suggested if some preservatives like Gamaxin or D.D.T. or Preventhol or any other suitable preservative is dissolved in water, say (5% solution) and then the skins are dipped in the above solution in the slaughter house itself and then sent to the tannery by cart, the tanner will get the expected yield and also to a certain extent better quality leather. Thus the tanner will be greatly benefitted.





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